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NORFOLK, VA

SENCORE VA62
"UNIVERSAL VIDEO ANALYZER"
MAINTENANCE INSTRUCTIONS

For Production Run Numbers 18 and higher
Last Update: January 22, 1984

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VA62 MAINTENANCE INSTRUCTIONS

For Production Run Numbers 18 and Higher
Last Updated: January 22, 1984

WARNING

To avoid electrical shock, do not perform any servicing (other than that contained in the VA62 "Operation and Application" manual) unless you are qualified to do so. Exposed AC line voltages and high voltages (up to 450 volts) are present at certain test points inside the VA62. Observe the cautions and warnings marked on the chassis and in these instructions when working on the VA62.

INTRODUCTION

These maintenance instructions explain how to service the Sencore VA62 Universal Video Analyzer. They fall into three general sections: 1) Access and Disassembly, 2) Performance Testing, and 3) Recalibration.

Refer to the schematic (which was packed with the unit) if a circuit requires repair. The schematic includes a printed-circuit (PC) board location diagram, foil layouts for each major PC board, an overall block diagram, a parts list, and parameters for the transistors used in the VA62. Additional copies may be ordered from the Sencore Service Parts Department. *1

Most Sencore parts contain the industry-standard JEDEC *2 part number. In most cases, you can replace a Sencore part with a part containing the exact JEDEC part number as long as the part comes from a reputable source. Sencore does not recommend the use of "cross-reference" parts in any of its circuits.

Some circuits require parts which have been carefully graded or selected. Call the Sencore Service Department *1 and ask to speak to a VA62 technician if you need to know if a part requires special selection. Graded or selected parts should always be ordered from Sencore for reliable operation.

Any parts for the VA62 may be purchased directly from the Sencore Service Parts Department *1. All Sencore parts are 100% pre-tested for reliable operation. For best service, please indicate: 1) That the part is for a VA62, 2) The schematic reference number of the part you are ordering, and 3) The run number *3 (including any "dash-numbers" next to the main run

*1 Sencore Service Department, 3200 Sencore Drive, Sioux Falls, SD 57107. Phone (605) 339-0100

*2 JEDEC--Joint Electron Device Engineering Council which is part of the Electronics Industries Association (EIA).

*3 The run number is on a sticker near the serial number. A second sticker is located inside the unit in case the outside one becomes detached.

number) of the VA62 you are servicing. This information allows us to send the correct part for your instrument, including any updates or improvements that may apply to a particular part.

I. ACCESS AND DISASSEMBLY

The following sections contain two levels of Access/Disassembly instructions. The first level ("General Access") explains how to open the unit to access the various controls needed for general testing or recalibration. The second level ("Service-Level Access") explains how to remove various sub-assemblies if you need to replace parts on them. You do not need to remove these sub-assemblies for general recalibration.

Sencore mechanical specifications require that a lock-washer be used under each screw that holds a PC board in place. Remember to replace these lock-washers upon reassembly to prevent the screws from working loose.

GENERAL ACCESS

The VA62 easily opens to its special "Service Position" which allows access to all internal test points and calibration adjustments. The VA62 operates normally in the service position, allowing accurate adjustment. Openings in metal shields allow adjustments to be made without removing the shields.

> NOTE: The VA62 contains 4 isolated electrical systems with non-common, floating grounds. Be sure to connect your test equipment to the ground that applies to the circuit you're testing. Be sure to check for proper isolation after servicing any of the isolated circuits.

WARNING

Several test points inside the VA62 contain dangerous voltages. Always disconnect power before making connections inside the unit. Use care when making tests when the power is on.

To open the VA62 to its "Service Position":

1. Place a soft pad on the bench and lay the VA62 face-down on the pad.
2. Remove the 4 screws on the bottom of the unit and the 4 screws on the back of the unit.
3. Remove the case-bottom by pulling it straight back, sliding it out along the bottom metal rails.
4. Grasp the handle with one hand and the edge of the case just above the lead-storage compartment with the other hand. Remove the case by sliding it straight back from the unit.
5. Set the unit upright on the bench.

6. Remove the 2 silver screws in the top of the inside chassis immediately behind the black, plastic case-wrap.
7. Open the inside chassis by grasping the inside chassis and folding it back along its hinged edge.

You now have access to all internal adjustments. No further disassembly is required for recalibration or general testing.

SERVICE LEVEL ACCESS

Each PC board can be removed for servicing. Most of the boards are held in place with four mounting screws. Disconnect the multi-conductor connectors, remove the mounting screws, and slide the PC board from the unit. A few PC boards require special procedures for removal or remounting. These will be covered, board by board, below.

WARNING

All VA62 PC boards contain components that may be damaged by static electricity. 1. Never remove a board unless you have been properly grounded to earth ground through a 1 megohm protection resistor, and 2. Never lay the PC board on a non-grounded or insulated surface which may contain high levels of static charge.

Connectors

With a few exceptions, the number of conductors on each connector is different than all other similar connectors on each PC board to prevent connecting the wrong cable to the wrong connector. (The exceptions are listed below with the specific PC board instructions.)

Two types locking connectors are used. The smaller, red connectors have a lip on the cable connector that overlaps a locking device on the PC connector. Simply grasp the ends of the red connector, and rock the connector slightly from end to end (while pulling the connector away from the PC board) until the locking lip clears the locking device. Then, pull the connector straight off. (NOTE: Do not grasp the wires when removing connectors. Always grasp the plastic connector body.)

The second type of connector uses the same type of locking device on the PC connector but does not have a locking lip on the cable connector. The locking device holds the connector in place by side friction. Simply pull the connector straight away from the PC board. When replacing this type of connector, the smooth plastic side of the connector must face the locking device. (The metal connectors, showing through the slots on one side, always face away from the locking device.)

Special PC Board Precautions

A few added notes will help you dismantle or reassemble the VA62 easier. The processes are not complicated, but will help you get the particular assemblies out of and into the unit without problem. The PC boards that are not listed below only require

general care, such as avoiding pinched wires or other mechanical problems during reassembly.

You do not need to remove any of the PC boards for routine recalibration or calibration performance testing. These procedures should only be needed when repairing defective circuits.

WARNING

Disconnect the power to the VA62 before removing any of the PC boards. Failure to do so presents a shock hazard and increases the chances of damaging electronic parts inside the unit.

The following notes are in order according to the PC board numbers assigned on the VA62 schematic. Use the PC board location diagram on the front of the schematic to locate each board. Observe the following precautions and special procedures if it becomes necessary to repair circuits on any of these PC boards:

200 "P.L.L." Board

DISASSEMBLY: The 200 board has 5 screws rather than the 4 found on the other boards.

800 "Meter/Ringer" Board

NOTE: Access holes allow youto recalibrate the controls on this board with the shield in place.

WARNING

The shield of the Meter/Ringer board is electrically isolated from the VA62 chassis. Be sure to test for proper isolation after performing any service on these circuits.

DISASSEMBLY:

1. Remove the 1 black screw on the top of the shield box.
2. Lift the box cover up and out of the chassis.
3. Remove the "1900 Power Supply" board (on the outside of the shield can, facing the center of the unit) first, as the pins running to the connector board inside the shield holds the 800 board in place.
4. Make sure the two black coaxial cables do not bind between the top of the PC board and the screw bracket on the shield can as you pull the board from inside the can.
5. Tip the top of the board outward to clear the screw bracket, then lift the board out of the shield box.

900 "Main Power Supply" Board

WARNING

Be sure to maintain the isolation among the different floating grounds in the power supply. Failure to do so will not damage the VA62, but may cause damage to circuits tested by the VA62 that require insolated connections.

DISASSEMBLY: Five screws hold the 900 board in place. Two pass through the PC board itself near the fold-out hinge. The remaining 3 screws pass through the aluminum sub-chassis. Fold the sub-chassis to the closed position to get at these screws. Lift the board out of the unit after all 5 screws have been removed.

NOTE: The 3 screws for the 900 board aren't insulated from the aluminum sub-chassis. Do not remove the screw passing through the sub-chassis that includes an insulating shoulder washer.

ISOLATION CHECK: The 900 board has 9 power regulator devices (transistors and ICs) along one edge. These mount to the aluminum heat sink. Most of these devices are isolated from the heat sink. Be sure to double-check each device for isolation before applying power if you have serviced the 900 board. You must use a low-power ohmmeter *4 to make these tests to prevent the various solid-state devices from causing incorrect readings. The chart below shows the resistance from the mounting screw of each power device to the heat sink, moving from left to right across the heat sink.

RESISTANCE TO HEAT SINK

DEVICE	RESISTANCE
TR4	**
IC5	**
IC1	0
IC2	13.9K
IC4	**
IC3	0
IC8	**
IC9	**
IC11	**

** Over 2 megohms

Fig. 1--Test for proper isolation of the power devices if the 900 board has been removed or serviced.

*4 A "low-power" ohmmeter uses a test voltage less than 200 mV to prevent diode junctions from conducting and producing invalid readings.

1000 "Drive Amplifier" Board

> NOTE: The heat sink for the power devices on the 1000 board must be isolated from the main sub-chassis. In addition, the power devices must all be isolated from the heat sink. Always check for isolation if the 1000 board has been removed.

DISASSEMBLY: The 1000 board has 4 screws holding it in place. Two are located on the edge of the PC board near the fold-out hinge. (Each of these screws also holds a plastic cable-tie in place.) One is behind the large electrolytic capacitor mounted in the corner of the board. The fourth screw comes through from the top of the sub-chassis.

> NOTE: There are four screws coming through the sub-chassis. The only one that holds the 1000 board in place has an insulating washer. Don't remove the uninsulated screws when removing the 1000 board.

REASSEMBLY: The two screws that hold the heat sink in position (the one coming through from the sub-chassis and the one near the hinge that is closest to the center of the unit) have insulating washers. These will probably fall away from the screws as you remove the screws. Retrieve the washers before they become lost. The insulating washers must be replaced upon reassembly.

Follow these steps to replace the PC board with its insulators:

1. Place the square black insulator (which keeps the 1000 board head sink from touching the sub-chassis) into position on the sub-chassis.
2. Place a lock-washer on a screw. Then place an insulating shoulder washer over the lock washer with the shoulder of the washer facing away from the screw's head.
3. Move the 1000 board into position, being careful not to push the insulator (from step 1) out of its position.
4. Thread the screw and washer assembly (from step 2) through the hole in the sub-chassis and turn it a few turns into the threaded hole on the end of the heat sink on the PC board. Do not tighten the screw yet.
5. Place a lock-washer onto a screw. Slip this screw through the plastic cable holder that attaches to the heat sink near the hinge. Then thread a shoulder washer onto this screw with the shoulder facing away from the screw head.
6. Holding the assembly from step 5 with your right hand, take the remaining shoulder washer with your left hand. Face the shoulder towards the PC board. Slip it between the heat sink and the threaded standoff with the shoulder seated in the hole in the heat sink. Hold the shoulder washer between the PC board and the standoff by pressing the PC board lightly against the washer.
7. Thread the screw/washer/cable holder assembly through the hole in the heat sink. Turn it into place until nearly tight.
8. Insert the remaining two screws. (Don't forget to slip the plastic cable holder under the screw on the side of the PC

board near the hinge).

9. Tighten all four screws (don't forget to tighten the one that goes through the sub-chassis).

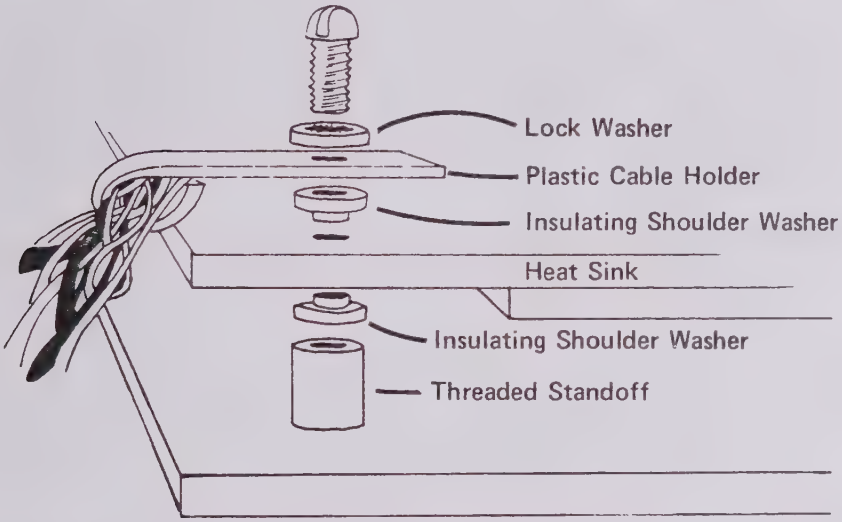

Fig. 2--Placement of insulating washers for 1000 board.

The two, two-conductor connectors for connections 16 through 19 (next to the large electrolytic capacitors in the corner of the board) are color coded. Mount the yellow connector closest to the front of the unit. The blue one mounts closest to the large capacitor. When correctly positioned, the shields on these two connectors occupy the center two conductors of the four conductors.

1100 "Video Pattern" Board

DISASSEMBLY: The board uses 6 screws, rather than 4 as with most of the VA62 PC boards. It is necessary to clip the single cable tie that connects the blue and black twisted-pair jumper wire running from the lower, left corner to the upper, right corner of the board to completely remove the board from the unit.

REASSEMBLY: Two coaxial cables connect to test points 55-58 using brown two-conductor connectors. In order to connect the correct cable to the correct circuit, install the connectors with the two black shield-wires toward the center. As with all connectors in the VA62, these connectors must be mounted with slots showing the metal connectors facing away from the locking device .

Remember to remount the cable clamps under the two outside screws closest to the corner of the sub-chassis.

1300 "30 Hz/3.58 MHz Drive" and 1400 "45.75 MHz Oscillator" Boards

DISASSEMBLY: The mounting screws are inside the shield. Lift the shield off to obtain access to them.

1700 "RF/IF Attenuator" Board

NOTE: Changing parts or the placement of parts on the 1700 board may change the calibration of the attenuator. Electrical recalibration of this attenuator is controlled by the program in the RF-IF microprocessor memory. Reprograming of this memory requires special equipment and procedures. Service of the attenuator should generally be done only at the Sencore factory.

DISASSEMBLY: You do not have to remove the PC board from inside the shield to remove components. Unsolder them from the component side.

REASSEMBLY: Connect the two coaxial cables running to the side of the shield to the correct connectors. The cable that runs along the edge of the chassis to the 1800 "RF" board connects to the jack farthest from the front panel. The cable running through the hole in the chassis connects to the front jack.

The connectors on each end of the cable running between the 1700 "Output Attenuator" board and the 1800 "RF" board have different lengths of center conductors. The short conductor must connect to the 1800 board end.

1800 "RF" Board

NOTE:The placement of parts on the UHF oscillator and the 512 MHz oscillator boards is critical. Changing parts may affect output calibration, requiring service at the factory. Do not remove these boards unless absolutely necessary.

DISASSEMBLY: The 1500 "512 MHz" oscillator and the 1600 "UHF" oscillator PC boards are held in place with two screws and a soldered pin. The pin must be unsoldered before the board can be removed. After removing the mounting screws and unsoldering the pin, simply pull the small board out of the shield by pulling the plastic connector with a needle-nose pliers.

Fig. 3--Location of the soldered pin on the "1500" board.

Fig. 4--Location of the soldered pin on the "1600" board.

NOTE: The ground pin must be resoldered and both mounting screws must be in place for the oscillators to work correctly. Failure to properly mount the oscillator boards causes them to become mistuned.

In order to reduce the chances of shorts to the wires, the ground connections of the feedthrough capacitors on the bottom of the 1800 board are usually not soldered to the foil on the bottom of the 1800 PC board. These capacitors are soldered on the top side of the board (under the 1500 and 1600 boards) so it isn't necessary to solder them on the bottom too.

REASSEMBLY: The connectors on each end of the cable running between the 1800 board and the 1700 "Output Attenuator" board have different lengths of center conductors. The short conductor must connect to the 1800 board end.
equipment to test the VA62.

EQUIPMENT	MINIMUM SPECIFICATIONS	EXAMPLE
Frequency Counter	1 GHz, 5-14 mV Sensitivity 1 PPM Accuracy	Sencore FC71
Spectrum Analyzer	1 GHz, -50dBm Sensitivity (With 75/50 ohm input pad)	Cushman CE15
Digital Meter	3-1/2 digit, 0.1%	Sencore DVM56A
Meter Calibrator	0.02% DC, 0.1% @ 1 KHz	Fluke 5010A
AC Hi-Pot Tester	1080 VAC @ 4.5 mA	Biddle 230305
DC Hi-Pot Tester	2500 VDC, current-limited	Biddle 220005
Digital Readout Oscilloscope	Delta Time Function Dual Trace	Sencore SC61
NTSC Vectorscope	1% amplitude, 1 degree phase	Tektronix 1420
NTSC Waveform Monitor	1% Amplitude, IRE scale	Tektronix 528A
Deflection Yoke	TV-type, Known Good	---
TV Receiver	Properly Adjusted, Cable Channel Tuner	GE EC-F
FM Deviation Meter	4.5 MHz, 15 KHz range	---

Fig. 5--Equipment needed to test/recalibrate the VA62.

PERFORMANCE TESTS

A. AC SAFETY TEST

These tests confirm that the AC line input conductors are properly isolated from the chassis. Use a standard high-potential AC leakage (Hi-Pot) tester to check for leakage between both sides of the AC line and the chassis. The maximum allowable leakage is 4.5 mA with an applied voltage of 1080 VAC (3055 VPP).

> NOTE: The test should be made at 1080 volts to meet Sencore's safety specifications. If you use a safety tester that uses 117 VAC (such as the Sencore AC "Powerite"), the maximum leakage current is 500 microamperes rather than the 4.5 mA allowed at 1080 VAC.

There are two ways to test for leakage, depending on the design of your Hi-Pot tester. Some have a meter which reads leakage current. Use the meter to confirm the leakage current is below the specified value. Other testers use an automatic shutdown circuit which removes power if the leakage current exceeds a specified value. The current trip point on these testers is often adjustable. If so, adjust the trip-point of the tester to the specified value before making the test. (Refer to the Hi-Pot tester's instruction manual for details on adjusting the current trip point.)

WARNING

Use extreme care when making Hi-Pot tests.
1. Remove power from the Hi-Pot testers as soon as you finish with each section of the safety test.
2. Make certain the VA62 is on an insulated surface when making the Hi-Pot test.

3. Do not touch any part of the VA62 during the high-pot test.

To test for AC leakage:
1. Connect one lead of the AC Hi-Pot tester to the VA62 chassis.
2. Use a jumper wire to connect the second lead of the Hi-Pot tester to both blades of the VA62 AC plug at the same time.
3. Turn the VA62 AC power switch to the "on" position.
4. Set the voltage on the Hi-Pot tester to 1080 volts AC.
5. Apply power to the Hi-Pot tester while reading the resulting leakage current. (NOTE: Some Hi-Pot testers require you to increase the voltage from zero to the test voltage. If so, operate your tester according to its normal operating instructions.)

The current reading must be less than 4.5 mA with a test voltage of 1080 VAC.

B. OUTPUT SIGNAL ISOLATION
The VA62 has three outputs which are isolated from the chassis and from each other: 1) The adjustable DC power supply, 2) The external meter input, and 3) The Drive Signal output. All three isolated outputs must be tested for leakage to the chassis and to each other. The maximum allowable leakage is 1 mA with an applied test voltage of 500 VAC (1400 VPP) from the Hi-Pot tester.

WARNING

Be sure to remove power from the Hi-Pot tester between each step of the isolation test. Do not touch the VA62 during the test.

To test the isolated outputs:
1. Remove power from the Hi-Pot tester.
2. Switch the DIGITAL METER switch to the "EXT PPV" position so the input jacks are connected to the internal circuits.
3. Connect one lead of the Hi-Pot tester to the metal chassis (use the ground connector of the RF-IF OUT connector).
4. Connect the second lead of the Hi-Pot tester to the black banana jack next to the "EXT. PPV & DCV IN" jack.
5. Apply power to the Hi-Pot tester (at 500 VAC). The leakage must be less than 1 mA. REMOVE POWER TO THE HI-POT TESTER.
6. Move the Hi-Pot tester lead from the common lead of the "EXT PPV & DCV IN" jack to the black banana jack of the "DRIVE OUTPUT".
7. Move the DIGITAL METER switch to the "DRIVE SIGNAL" position to connect the meter circuits to the drive circuits.
8. Apply power to the Hi-Pot tester. The leakage must be less than 1 mA. REMOVE POWER TO THE HI-POT TESTER.
9. Move the Hi-Pot tester lead from the DRIVE OUTPUT jack to the black banana connector of the "DC OUTPUT".
10. Move the DIGITAL METER switch to the "DC PWR SUPPLY VOLTS" position to connect the meter circuits to the power supply.
11. Apply power to the Hi-Pot tester. The leakage must be less than 1 mA. REMOVE POWER TO THE HI-POT TESTER.
12. Repeat the Hi-Pot test between the DC OUTPUT jack and the EXT

PPV & DCV IN jack and between these two jacks and the DRIVE OUTPUT.

C. METER INPUT PROTECTION

The protection circuits on the "EXT PPV & DCV IN" jacks should clamp the input at a maximum voltage of between 2000 and 2500 volts DC. To test the protection circuits, apply an adjustable, current-limited DC voltage (DC Hi-Pot tester) to the input. Slowly increase the voltage until the protection circuits begin to conduct current.

The VA62 digital meter should read the input voltage as you increase it to 1999 volts. The meter should then show an overrange as flashing "888". The testing power supply should show minimum loading at this point, indicating the protection circuits have not begun to conduct.

Continue to slowly increase the test voltage (to a maximum of 2500 volts) until the DC Hi-Pot tester shows an increase in current. (Some testers indicate conduction with a current meter reading, while others shut down when the circuit under test begins to draw current.) The conduction must begin between 2000 and 2500 volts DC. DO NOT APPLY MORE THAN 2500 VOLTS TO THE INPUT--REPAIR THE M.O.V. INPUT CIRCUITS IF THEY HAVE NOT BEGUN TO CONDUCT BY 2500 VOLTS!

To test the meter input protection:

1. Connect the DC Hi-Pot tester between the "EXT PPV & DCV IN" jacks, with the positive lead connected to the red jack.
2. Set the DIGITAL METER switch to the "EXT DCV" position.
3. Adjust the DC Hi-Pot tester for an output less than 2000 volts.
4. Observe the digital readout on the VA62 as you increase the DC output of the DC Hi-Pot tester. The meter should read the DC voltage until 1999, and then show an overrange condition.
5. Continue to increase the DC output of the DC Hi-Pot tester until it shows the VA62 protection circuits begin to conduct. DO NOT APPLY MORE THAN 2500 VOLTS TO THE INPUT!

The protection circuits must begin to conduct between 2000 and 2500 VDC.

D. RF/IF FREQUENCY TESTS

Use a high accuracy, high sensitivity frequency counter to test the frequencies produced by the RF generator. Most frequency counters will show incorrect readings on cable channels up to channel 44. *5 This requires you to use a low-pass filter, like the one shown in Fig. 6 for accurate measurements.

*5 Cable channels 69-73 have lower video carrier frequencies than cable channel 14 because the industry did not number cable channels in sequence. See page 72 of the VA62 manual. for details.

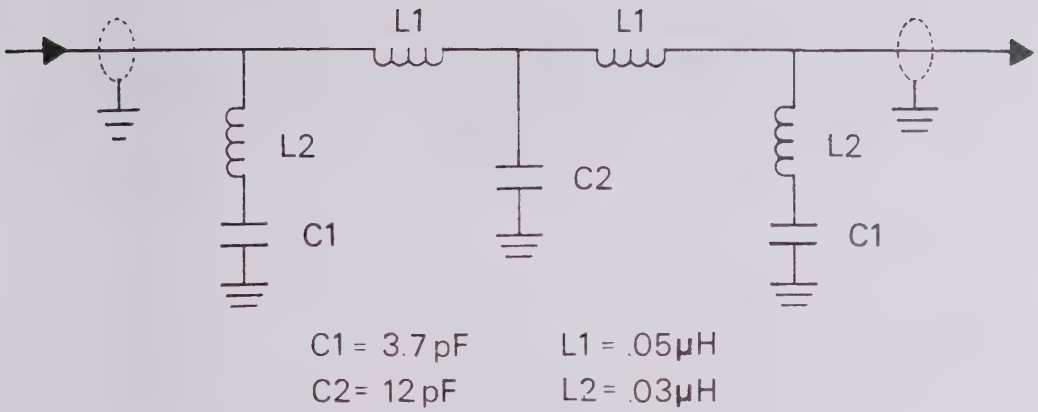

Fig. 6--A VHF low-pass filter needed to test the frequency of channels below cable 44.

Feed the VA62 signal to the 50-ohm, high frequency input of the counter. Be sure to use a frequency counter with adequate sensitivity. The Sencore FC71 is able to test all channels through UHF channel 83 without the use of external amplifiers. Other counters may need one or more low-noise, wideband amplifiers in series with the input to measure the VA62 output.

Most frequency counters will not show accurate or stable readings when modulation is applied to the RF carrier. Remove modulation by selecting the "External Modulation" function of the VIDEO PATTERN switch with no signal applied to the external input. Also be sure the AUDIO switch is in the "OFF" position to eliminate the audio carrier.

RF Channels

Since the VA62 produces the RF carrier using a phase-locked-loop, it's generally not necessary to test every channel. The following table shows a typical test sequence, along with the frequency tolerance (in KHz) for the given channel. If you want to test every channel, refer to the table on page 72 of the "Operation and Application" manual for a listing of all of the VHF and cable channels produced by the VA62. Allow a 400 PPM tolerance on each channel. See Fig. 7 for tolerances on typical channels.

Selected channel frequencies:

BAND	CHANNEL	CORRECT FREQ. (MHz)	TOLERANCE (+KHz)
Std. TV	2	55.25	22
	6	83.25	33
	7	175.25	70
	13	211.25	84
Std. Cable	69	91.25	37*
	73	115.25	46*
	14	121.25	49*
	18	145.25	58*
	22	169.25	68*
	23	217.25	87*
	29	253.25	101*
	36	295.25	118*
	44	343.25	137
	53	397.25	159
	59	433.25	173
	64	463.25	185
	68	487.25	195
Std TV	14	471.25	189
	30	567.25	227
	60	747.25	299
	83	885.25	354

*Use VHF LOW-PASS FILTER ON MARKED CHANNELS

Fig. 7--The RF channels should fall within these tolerances.

Press the channel up button. The channel indicator should move up one channel (NOTE: If you are at "STD TV" channel 83 or cable channel 73, the channel indicator should "wrap around" to channel 2). Press the channel down button. The channel indicator should move down one channel (NOTE: If you are at channel 2, the channel should "wrap around" to channel 83 for "STD TV", or channel 73 for either cable function.) The frequency reading should correspond to the newly selected channel.

Programmable Channels

To test the programmable cable RF generator:

1. Set the RF-IF SIGNAL switch to the "Prog Cable" position.
2. Select channel 6
3. Feed in the following channel offsets and watch for the correct frequency readings:

ENTER SHIFT	COUNTER READING (MHz)	TOLERANCE (+KHz)
000	83.25	33
-025	83.00	33
-100	82.25	33
-975	73.50	33
+050	83.75	33
+100	84.75	33
+975	93.00	33

Fig. 8--Test of "Prog. Cable" shifting.

The special Electrically Alterable Programmable Read Only Memory (EAPROM) used to store the user's desired shift for each channel can be reset to a zero shift on every channel.

> NOTE: This procedure initializes all programmed cable shifts to zero. Do not use this procedure unless you are certain that all program shifts should be reset.

To initialize the EAPROM for zero frequency shift on all channels:

1. Press the "C" button.
2. Press the "+/-" button.
3. Press the "8" button five times.
4. Wait until two dashes appear in the left-hand digital display.
5. Confirm that channel 6 now shows a zero shift by pressing "06" and the "+/-" key. The display should read "0.00".

IF Generator

The IF Generator produces output levels that are 40 dB larger than the RF channels for each setting of the output attenuator. Most frequency counters will not require external amplifiers to measure these higher signal levels. Many counters will not measure amplitude-modulated signals. Turn the VIDEO PATTERN switch to the "EXTERNAL MODULATION" position to remove video modulation, and the AUDIO switch to the "OFF" position to remove amplitude-modulation from the "35-50 MHz PROG" and the "TRAP" functions and to remove the audio carrier from the "45.75 MHz VIDEO IF" function.

To test the IF generator:

1. Set the VA62 RF-IF SIGNAL switch to the "35-50 MHz PROG" position.
2. Enter several frequencies between 35 and 50 MHz. Each should read within 10 KHz of the selected frequency.
3. Enter a frequency lower than 35 MHz, such as 34.00. The digital display should show "- -" (the frequency reading is unimportant).
4. Enter a frequency higher than 50 MHz, such as 51.00 or 99.00. The digital display should show "- -" (the frequency reading is unimportant).
5. Move the RF-IF SIGNAL switch to the "45.75 MHz VIDEO IF" position. The frequency reading should show 45.75 MHz within

10 KHz.

6. Move the RF-IF SIGNAL switch to each of the three trap signals (39.75, 41.25, and 47.25 MHz). (NOTE: These signals contain a 1000 microvolt 45.75 MHz signal along with the selected frequency. Many counters will have trouble reading the trap frequency at low amplitude. Increase the setting of the RF-IF LEVEL switch and control until your counter reads correctly.) Each signal must read within 10 KHz.
7. Move the RF-IF SIGNAL switch to the "4.5 MHz FM" position. The frequency reading should be within 1 KHz of 4.5 MHz.

E. RF/IF LEVEL TESTS

A microprocessor controls the RF/IF attenuator. The microprocessor contains calibration tables which correct attenuator errors on a channel by channel basis. Any changes in the RF generator or the attenuator of the VA62 changes the values compensated for by the microprocessor. The VA62 must be connected to a special calibration setup to re-detect the channel-by-channel calibration and then burn a new memory chip with the required table. The setup of this process is too detailed for these calibration instructions. Sencore recommends that any unit that requires RF or IF level calibration be returned to the factory for recalibration.

The following procedures allow you to test the VA62 RF/IF output calibration. If the unit passes these tests, there is no reason to return the unit for recalibration. If the unit fails the test, it should be returned to the Sencore factory.

The recommended method to test the output calibration is to use a spectrum analyzer capable of measuring to 1 GHz. As an alternative, a tunable signal-strength meter (accurate to at least 1 dB for VHF and 3 dB for UHF) may be used. (NOTE: Do not use a broadband RF voltmeter, as spurious signals may cause inaccurate readings.)

The test must be done in two steps. First, the calibration of the RF-IF LEVEL VERNIER must be tested at various channels. The vernier test is done at three settings of the control (5, 1, and .5) with the RF-IF LEVEL switch set to the "HI" position. The next step is to test the three steps of the RF-IF LEVEL switch at selected channels.

Vernier Attenuator

The following table shows the reading and the tolerance for selected channels. Two dB references are shown. The left-hand set of readings is referenced dBm (dB referenced to 1 milliwatt into 50 ohms) for use with a spectrum analyzer. Remember, however, that you need to use a 75 to 50 ohm impedance matching pad, which normally has a 6 dB loss. The table does not include this loss.

The right-hand set of readings is referenced to dBmV (dB referenced to 1 millivolts, or 1000 microvolts) for use with a signal-strength meter. Generally, no impedance matching pad is needed because most signal-strength meters have a 75 ohm input.

Simply connect the VA62's 75 ohm output to the signal-strength meter's 75 ohm input.

The frequency column helps you tune your spectrum analyzer or signal strength meter to the correct point for each channel. You may use other channels than those shown. Note that the tolerance remains the same for all VHF and cable channels, but changes channel by channel for UHF.

To test the Vernier, set the Step attenuator to "Hi" and:

		SPEC. ANALYZER*						S.S. METER					
VERNIER TO----		0.5		1.0		5.0		0.5		1.0		5.0	
CHAN.	FREQ.	dBm	+/-	dBm	+/-	dBm	+/-	dBmV	+/-	dBmV	+/-	dbmV	+/-
Std. TV													
2	55	-33	6	-47	3	-53	6	-6	6	0	3	+14	6
6	83	"	"	"	"	"	"	"	"	"	"	"	"
7	175	"	"	"	"	"	"	"	"	"	"	"	"
13	211	"	"	"	"	"	"	"	"	"	"	"	"
Std. Cable													
69	89	"	"	"	"	"	"	"	"	"	"	"	"
73	115	"	"	"	"	"	"	"	"	"	"	"	"
14	121	"	"	"	"	"	"	"	"	"	"	"	"
29	253	"	"	"	"	"	"	"	"	"	"	"	"
53	397	"	"	"	"	"	"	"	"	"	"	"	"
64	463	"	"	"	"	"	"	"	"	"	"	"	"
Std. TV													
14	471	-33	6	-47	3	-53	6	-6	6	0	3	+14	6
30	567	"	8	"	5	"	8	"	8	"	5	"	8
60	747	"	11	"	8	"	11	"	11	"	8	"	11
83	885	"	13	"	10	"	13	"	13	"	10	"	13

*Does not include losses for needed 75-to-50 ohm matching pad.

Fig. 9--Test of RF-IF Level Vernier.

Step Attenuator

The next step is to test the calibration of the step attenuator at various frequencies. To do so, set the RF-IF LEVEL VERNIER control to 5 and check the output at each setting of the switch. The tolerances shown below include the tolerance for the vernier control plus the tolerance for the step attenuator.

To test the step attenuator, set the VERNIER to 5 and:

		SPEC. ANALYZER*				S.S. METER			
STEP TO-------		MED		LOW		MED		LOW	
CHAN.	FREQ.	dBm	+/-	dBm	+/-	dBmV	+/-	dBmV	+/-
Std.	TV								
2	55	-53	6	-73	9	-6	6	-26	9
13	211	"	6	"	9	"	6	"	9
83	885	"	13	"	16	"	13	"	16
Std.	Cable								
14	121	"	6	"	9	"	6	"	9
29	253	"	"	"	"	"	"	"	"
44	343	"	"	"	"	"	"	"	"

*Does not include losses for needed 75-to-50 ohm matching pad.

Fig. 10--Test of RF-IF Step switch.

IF Levels

The IF level for each position of the RF-IF LEVEL switch produces a signal 100 times (40 dB) larger than the corresponding position for RF signals. The TRAP functions produce two signals at the same time. The reference, at 45.75 MHz, is at a constant 1000 microvolts. The marked trap frequency is adjustable through the full range of levels indicated by the setting of the RF-IF LEVEL switch and the RF-IF LEVEL VERNIER control. The second (trap) signal is the one you want to measure.

The IF signals should be tested at two settings of the RF-IF LEVEL VERNIER control for each setting of the RF-IF LEVEL switch. These settings are at 1 and at 5. The same measurements and tolerances apply to all of the IF signals.

	SPEC. ANALYZER*				S.S. METER			
VERNIER-------	0.0		5.0		0.0		5.0	
RF-IV LEVEL	dBm	+/-	dBm	+/-	dBmV	+/-	dBmV	+/-
Low	-47	3	-33	6	0	3	+14	6
Med	-27	3	-13	6	+20	3	+34	6
Hi	-17	3	+7	6	+40	3	+54	6

*Does not include losses for needed 75-to-50 ohm matching pad.

Fig. 11--Test of IF levels.

F. VIDEO PATTERN TESTS

Testing for correct video patterns and video modulation requires the use of a correctly adjusted TV receiver, an oscilloscope, a broadcast-type waveform monitor, and a broadcast-type color vectorscope. You will test the VA62's RF/IF output, "VCR Standard" output and drive output.

In order to test all of the VA62 functions, the TV receiver used should have a tuner capable of receiving cable midband and superband channels. It should also have automatic VIR (Vertical Interval Reference Signal) controlled color circuits.

Even the highest quality TV receivers available will have some variations from one unit to the next. But an operational receiver still provides the best test of overall VA62 operation.

The best way to use a TV receiver is to document its performance with a VA62 that you know works correctly. For example, using a new VA62 (or one recently recalibrated at the factory) lets you determine the normal receiver operation. Then, apply the VA62 you are testing to the same receiver to confirm the operation is the same as the "transfer standard" from the Sencore factory.

Connections

To set up your equipment for testing:

1. Connect the VA62 "RF-IF OUT" antenna input of the receiver.
   a. Set the TV tuner to a VHF channel which is not used by an over-the-air TV station in your area.
   b. Set the RF-IF SIGNAL switch to the "STD TV" position and select the same channel number as used in step 1a.
   c. Set the RF-IF LEVEL switch to the "HI" position, and set the RF-IF LEVEL VERNIER to "2".
2. Connect the "VCR STANDARD" to the broadcast waveform monitor and vectorscope. Loop the signal through the waveform monitor and terminate it at the vectorscope so you can monitor both displays without needing to switch cable connections.
   a. Connect the "VCR STANDARD" jack to the input of the waveform monitor.
   b. If the waveform monitor input has a switch that selects between "terminate" and "loop-through" or "bridged", set it to the "loop-through" or "bridged" position.
   c. Connect the "looped" or "bridged" output of the waveform monitor to the input of the broadcast-type color vectorscope.
   d. Switch the vectorscope input to the "terminate" position or connect a 75 ohm terminator to the "bridged" or "loop through" jack if there is no "terminate" switch.
3. Connect your oscilloscope to the "DRIVE OUTPUT" jack.
   a. Connect the oscilloscope ground lead to the black output connector and the the probe to the red output connector.
   b. Set the DRIVE RANGE switch to the "30VPP" position.
   c. Set the DRIVE LEVEL control fully to the "-" position (fully counter-clockwise).

You will now switch through each of the video patterns to confirm the VA62 produces the correct signal. You will examine each pattern on the receiver CRT. (See page 11 of the VA62 "Operation and Application" manual for photographs of the video patterns.) Plus, you will measure key parameters on some of the patterns using the instruments connected to the "VCR STANDARD" and "DRIVE OUTPUT" jacks.

NOTES: 1. Interlaced sync causes the video pattern to jitter vertically. Leave the "INTERLACE ADDER" turned off unless a procedure tells you to turn it on.

Even the highest quality TV receivers available will have some variations from one unit to the next. But an operational receiver still provides the best test of overall VA62 operation.

The best way to use a TV receiver is to document its performance with a VA62 that you know works correctly. For example, using a new VA62 (or one recently recalibrated at the factory) lets you determine the normal receiver operation. Then, apply the VA62 you are testing to the same receiver to confirm the operation is the same as the "transfer standard" from the Sencore factory.

Connections

To set up your equipment for testing:

1. Connect the VA62 "RF-IF OUT" antenna input of the receiver.
   a. Set the TV tuner to a VHF channel which is not used by an over-the-air TV station in your area.
   b. Set the RF-IF SIGNAL switch to the "STD TV" position and select the same channel number as used in step 1a.
   c. Set the RF-IF LEVEL switch to the "HI" position, and set the RF-IF LEVEL VERNIER to "2".
2. Connect the "VCR STANDARD" to the broadcast waveform monitor and vectorscope. Loop the signal through the waveform monitor and terminate it at the vectorscope so you can monitor both displays without needing to switch cable connections.
   a. Connect the "VCR STANDARD" jack to the input of the waveform monitor.
   b. If the waveform monitor input has a switch that selects between "terminate" and "loop-through" or "bridged", set it to the "loop-through" or "bridged" position.
   c. Connect the "looped" or "bridged" output of the waveform monitor to the input of the broadcast-type color vectorscope.
   d. Switch the vectorscope input to the "terminate" position or connect a 75 ohm terminator to the "bridged" or "loop through" jack if there is no "terminate" switch.
3. Connect your oscilloscope to the "DRIVE OUTPUT" jack.
   a. Connect the oscilloscope ground lead to the black output connector and the the probe to the red output connector.
   b. Set the DRIVE RANGE switch to the "30VPP" position.
   c. Set the DRIVE LEVEL control fully to the "-" position (fully counter-clockwise).

You will now switch through each of the video patterns to confirm the VA62 produces the correct signal. You will examine each pattern on the receiver CRT. (See page 11 of the VA62 "Operation and Application" manual for photographs of the video patterns.) Plus, you will measure key parameters on some of the patterns using the instruments connected to the "VCR STANDARD" and "DRIVE OUTPUT" jacks.

NOTES: 1. Interlaced sync causes the video pattern to jitter vertically. Leave the "INTERLACE ADDER" turned off unless a procedure tells you to turn it on.

2. Audio modulation causes interference in the video patterns because of the method used to add the audio carrier in the VA62. Leave the AUDIO switch in the "OFF" position for all tests unless instructed to add modulation.

To test the video patterns:

1. Set the VIDEO PATTERN switch to the "DOT" position with the "INTERLACE ADDER" button released to the "out" position.
   a. A single white dot should be in the approximate center of the CRT screen (NOTE: The exact position depends on the adjustment of the receiver.)
   b. Adjust the "DOT SIZE" control through its full range. The size of the dot should change on the CRT screen (NOTE: The "DOT SIZE" control affects the dot's width but does not affect its height.) The dot should not disappear on a properly adjusted receiver.
2. Set the VIDEO PATTERN switch to the "CROSS" position.
   a. Confirm the cross contains both the horizontal and the vertical line. (NOTE: The "DOT SIZE" control affects the width of the vertical line in the "CROSS" video pattern.)
   b. Switch the waveform monitor to view horizontal information.
      1) Set the sweep rate to the "2H" mode.
      2) Adjust the vertical position until the blanking signal falls at the "0" IRE *6 marking.
      3) Adjust the vertical gain and vertical position controls until the sync pulse tip is at the "-40" IRE marking while blanking is still at the "0" IRE marking.
      4) Set the frequency response to "Flat" response.
   c. Confirm that the horizontal line is at the 100 IRE (±10%) marking.
   d. Turn the "DOT SIZE" control to minimum (fully counter-clockwise). The waveform monitor should show the vertical line (the pulse half way between sync pulses) between 20 and 30 IRE units.
   e. Turn the "DOT SIZE" control to maximum (fully clockwise). The waveform monitor should show the vertical line at the same amplitude as the horizontal line. (It must not be higher in amplitude than the horizontal line.)
3. Set the VIDEO PATTERN switch to the "CROSSHATCH" position. Confirm the correct pattern appears on the receiver CRT. (NOTE: The "DOT SIZE" control affects the width of the vertical lines in the "CROSSHATCH" video pattern.)
4. Set the VIDEO PATTERN switch to the "DOTS" position. Confirm the correct pattern appears on the receiver CRT.
5. Set the VIDEO PATTERN switch to the "COLOR BARS" position.
   a. Confirm the correct pattern appears on the receiver CRT.

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*6 IRE means "Institute of Radio Engineers" which established standards for testing video signals. There are 100 IRE units between pure black and pure white and 40 IRE units between blanking and the tip of the sync pulse.

1) Turn the "INTERLACE ADDER" off. The edges of color bars must remain locked, like gear teeth.
2) Turn the "INTERLACE ADDER" on. The edges of color bars should appear to move upward.

b. Confirm the color burst amplitude is 40 IRE units, ±2%.
1) Set the waveform monitor for calibrated gain and flat response.
2) Adjust the vertical position control until the blanking level is at the 0 mark.
3) Confirm the burst extends from -20 to +20 IRE units, ±2%.

c. Use the vectorscope to confirm that the third bar (loop) is in the "R-Y" area (NOTE: The "R-Y" vector is the graticule line running straight up and down, not the "red" box for the EIA-NTSC color bar pattern). The center of the loop should fall within ±30 degrees of the R-Y line.
1) Center the pattern with the vertical and horizontal position controls.
2) Adjust the vectorscope "Phase" control until the color burst lines up with the burst reference mark on the vectorscope graticule.
3) Adjust the vectorscope "Gain" control until the color burst amplitude is at its correct position, at the calibrated mark on the vector graticule.
4) Note the position of the third bar.

6. Set the VIDEO PATTERN switch to the "CHROMA BAR SWEEP" position.

a. Release the 3.0, 3.5, and 4.0 MHz "MULTIBURST BAR SWEEP INTERRUPT" buttons to their "out" position. The CRT screen should show a pure white picture.

b. Set the waveform monitor for calibrated gain. Set the vertical position control to place the blanking pedestal on the "0" IRE mark. Sync should read -40 IRE ±2%, black should read 7.5 IRE ±2%, white should read 100 IRE ±2%.

c. Turn on the center bar by pressing the "3.5" "MULTIBURST BAR SWEEP INTERRUPT" button.
1) The center bar should show as cyan (blue-green) on CRT screen.
2) The vector for the center bar should fall within the small vector box for cyan on the vectorscope.

d. Turn on left and right bars by pressing "3.0" and "4.0" "MULTIBURST BAR SWEEP INTERRUPT" buttons.
1) The left and right bars must appear on the CRT.
2) The left bar should show 5 repetitions of color on the CRT.
3) The right bar should show color (the color intensity may be restricted by the receiver).
4) The left and right bars should be same height as the center bar on the waveform monitor.
5) Change the waveform monitor frequency response to "IRE". The right-hand bar should not show a double image.
6) Check the Drive Output with the scope. The bars

should be 50 to 80 percent the peak-to-peak amplitude compared to the peak-to-peak amplitude difference between black and white.

7. Depress the "VIR ADDER" button to test for correct operation. (NOTE: Most VIR receivers require interlaced sync. Be sure the "INTERLACE ADDER" button is pressed.)
NOTE: Leave the VIDEO PATTERN switch in the "CHROMA BAR SWEEP" position.
   a. Confirm the VIR light on the receiver comes on.
   b. Confirm the (properly adjusted) receiver shows the center bar as being cyan.
   c. Confirm that the VIR vector on the vector scope is the same phase as the color burst. (NOTE: This vector should appear to the left of the color burst, at about twice its amplitude. It will be much dimmer than the other vectors. Turn the "VIR ADDER" off and on to confirm you are looking at the correct vector.)
   d. Set the waveform monitor to the "2V Expanded" horizontal sweep mode. Confirm that the VIR reference signal has two steps; one at 100 IRE (±2%) and the other at 50 IRE (±2%).
8. Set the VIDEO PATTERN switch to the "MULTIBURST BAR SWEEP" position.
   a. Release all "MULTIBURST BAR SWEEP INTERRUPT" buttons to their out position. The CRT screen should show black raster.
   b. Starting from the left, press one "MULTIBURST BAR SWEEP INTERRUPT" button at a time. Each should add a bar to the CRT with more vertical stripes than the previous bar.

NOTE: A receiver with standard resolution will not show stripes in the 3.5, 4.0, or 4.5 MHz bars. A high resolution monitor (with a direct video input) may show resolution all the way to the 4.5 MHz bar if you connect the "VCR STANDARD" output to the direct video input. Be certain the "sharpness" control on the receiver is adjusted for maximum detail, or the higher frequency bars will automatically be restricted.

   c. Set the vertical gain of the waveform monitor to the "calibrated" position.
   d. Observe the bars on waveform monitor. All bars should have equal amplitude--extending from black (7.5 IRE) to white (100 IRE), ±2%.
   e. Observe the bars on the scope connected to the Drive Output.
      1) Select the "3 VPP" position of the DRIVE RANGE switch. Adjust the DRIVE LEVEL control until the first bar is 1.0 volts P-P from black to white. (NOTE: Use "Delta PPV" if you are using the Sencore SC61. Be sure to use the "TV" sync position for accurate Delta PPV readings.)
      2) The sixth bar (2.5 MHz) should be between 0.7 and 1.0 volts P-P. (NOTE: Move the "Delta Bar" if you're using the Sencore SC61.)
      3) The eighth bar (3.5 MHz) should be between 0.4 and 0.6 volts P-P.
9. Set the VIDEO PATTERN switch to the "10 BAR STAIRCASE"

position.

a. Confirm the correct pattern appears on the CRT screen, ranging from pure black on the left to pure white on the right. (NOTE: Be sure receiver's brightness and contrast controls have been properly adjusted or some of the bars may compress together.)

b. Confirm all 10 steps fall at equally spaced intervals (±10%) between black and white on the waveform monitor.

1) Adjust the vertical gain and vertical position controls of the waveform monitor until the first step is at the 7.5 (black) IRE mark and the flat part of the tenth step is at the 100 IRE (white) marking. (NOTE: Measure only to the flat top of the tenth step. Ignore the spike on the extreme right side of the pattern.)

2) Confirm each bar falls within 10% of each of the ten equally spaced markings on the waveform monitor CRT graticule.

10. Test the "EXTERNAL MODULATION" function.

a. Apply a source of "NTSC-EIA Split-Field" color bar pattern to the "EXTERNAL MODULATION" jack on the back of the unit.

1) Use a Sencore NT64 to supply the pattern.

-or-

2) Use any known-accurate source of NTSC-EIA color bars (meeting EIA standard RS189 or better) which provides a 1 VPP amplitude into a 75 ohm load. (NOTE: Confirm the generator meets specifications by feeding it directly to the vectorscope before applying it to the VA62. If the vectors from the generator do not meet EIA specifications, it cannot be used for this test.)

b. Set the VIDEO PATTERN switch to the "EXTERNAL MODULATION" position.

c. Check the position of all color vectors on the vectorscope. Each should fall within the smaller "EIA" box, rather than the larger "FCC" tolerance boxes (±2.5 degree phase accuracy, ±2.5% amplitude accuracy).

G. RF/IF MODULATION TESTS

The following tests confirm that the video signals selected by the VIDEO PATTERN switch properly modulate the IF generator and all bands of the RF generator. Complete testing requires a TV receiver with the midband and superband channels used by cable TV (CATV) systems. You also need access to the cable that connects between the receiver's tuner and its IF input in order to test the VA62 IF generator.

RF Modulation Tests

1. Connect the VA62 "RF/IF OUT" connector to the receiver's VHF/Cable input. Set the receiver's "Cable/Normal" tuner switch to the "Cable" position.
2. Set the VA62 VIDEO PATTERN switch to the "10 BAR STAIRCASE"

position to test the modulation range of each channel.

3. Set the AUDIO switch to the "OFF" position.
3. Select a low-band VHF channel (channel 2-6) that does not receive a local off-the-air station.
4. Set the VA62 RF-IF SIGNAL switch to the "STD TV" position and select the same channel used in step 3.
5. Set the VA62 RF-IF LEVEL switch to the "HI" position and the RF-IF LEVEL VERNIER control to "2".
6. Turn up the receiver's volume control and test for audio modulation.
   a. Set the AUDIO switch to the "333 Hz" position and confirm a tone is heard at the speaker. (NOTE: It is normal for the audio carrier to create some picture interference because of the method used to mix the audio with the video information. Therefore, turn the AUDIO switch to the "OFF" position for all tests not requiring audio.)
   b. Repeat this test for the other three audio frequencies.
   c. Return the AUDIO switch to the "OFF" position to eliminate audio beats from the picture.
7. Adjust the receiver's brightness and contrast controls for the best contrast on all 10 bars on the CRT. Leave the controls set to these positions for the rest of the tests. (NOTE: Modulation problems are indicated if there is a noticeable change in the Staircase pattern on the CRT for certain channels on the following tests. Confirm the TV receiver works correctly on those channels before rejecting the VA62.)
8. Select a high-band VHF channel (channel 7-13) that does not receive a local off-the-air station.
9. Set the VA62 RF-IF SIGNAL switch to the same channel and compare the picture to the reference established in step 5.
10. Set the tuner to cable channel 20 *7
11. Set the VA62 RF-IF SIGNAL switch to the "STD CABLE" position and select channel 20. Compare the picture to the reference from step 5.
12. Repeat step 11 on cable channel 30.
13. Repeat step 11 on cable channel 40.
14. Move the connection on the back of the receiver from the VHF/Cable input to the UHF antenna input. (NOTE: Use a standard MATV-type 75 ohm to 300 ohm matching balun to make this connection rather than the 39G72 balun supplied with the VA62 *8) Set the "Cable/Normal" switch to the "Normal" position.
15. Select UHF channel 14 on the receiver.

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*7 Most "cable-ready" tuners use the same numbering sequence as the VA62 RF generator. Compare the receiver's instructions to the table on page 72 of the VA62 "Operation and Application" manual if there are questions as to the numbering sequence used.

*8 The long, flexible leads of the 39G72 balun supplied with the VA62 may become resonate at some UHF channels, causing reduced RF levels. The fixed spacing of the leads on an MATV-type balun prevents these resonances.

16. Set the VA62 RF-IF SIGNAL switch to the "STD TV" position and select channel 14. Compare the results to the earlier ones.
17. Repeat the test on UHF channel 30.
18. Repeat the test on UHF channel 50.
19. Repeat the test on UHF channel 83.

IF Modulation Test

The next tests require you to disconnect the tuner from the IF input and feed the VA62 signal directly to the IF stages. Leave the receiver controls set the same for this test as for the previous tests.

WARNING

Connect the TV receiver to an isolation transformer before making connections to the IF stages (unless the receiver contains its own isolation transformer). Failure to do so creates a severe shock hazard and will cause damage to the TV receiver and/or the VA62 if the receiver uses a hot ground power supply.

To test the IF modulation:

1. Disconnect the cable running between the receiver tuner and its IF input.
2. Connect the VA62 RF-IF cable to the IF input using a supplied adapter.
3. Set the VA62 RF-IF SIGNAL switch to the "45.75 MHz VIDEO IF" position.
4. Set the VA62 RF-IF LEVEL switch to the "LO" position.
5. Set the VA62 RF-IF LEVEL VERNIER control to the "1" position.
6. Connect your oscilloscope to the video detector output.
7. Set the VIDEO PATTERN switch to the "10 BAR STAIRCASE" position.
   a. Compare the results on the CRT to the previous tests.
   b. Confirm the linearity of the detector signal (viewed at the horizontal line rate) agrees with the normal "10 BAR STAIRCASE" response of your test receiver (compare to a known-good VA62 if necessary).
8. Move the VIDEO PATTERN switch to the "MULTIBURST BAR SWEEP" position.
   a. Confirm that the "MULTIBURST BAR SWEEP" pattern produces the correct picture on the CRT.
   b. Confirm that the scope at the detector shows the correct response for your test receiver.
9. Confirm that the audio modulation operates correctly by selecting all four positions of the AUDIO switch while listening for the correct output on the receiver's speaker.
10. Test the special trap setting signals.
    a. Turn the RF-IF SIGNAL switch to the "39.75 MHz TRAP" position.
    b. Turn the AUDIO switch to the "1 KHz" position.
    c. Adjust the RF-IF LEVEL VERNIER and the RF-IF LEVEL switch through their full range of signal levels.
    d. Confirm that the amount of interference in the picture becomes worse as the signal level is increased (NOTE: The interference may completely overpower the video

modulation at higher settings of the output controls. This is acceptable.)

e. Repeat steps c. and d. for the other two special TRAP signals. (NOTE: Each trap frequency may show different types of interference and respond with different settings of the output level controls. This is normal. You're main concern is that the amount of interference changes with different settings of the RF-IF LEVEL controls.)

11. Move the RF-IF SIGNAL switch to the "4.5 MHz FM" position.
    a. The picture should go blank.
    b. Select each position of the AUDIO switch. The receiver should produce a corresponding tone for each switch position.
12. Disconnect the VA62 from the IF stage and re-connect the tuner.

H. DIGITAL METER TESTS

Use a high quality meter calibrator to test the accuracy of the digital meter functions. Test the autoranging DC voltmeter with the same procedures you would use for testing any digital voltmeter. Since the ranges switch at multiples of 1.999 volts, a test is needed just below and just above the range-switch point.

DC Volts

This table shows typical test signal levels and resulting tolerances:

INPUT	VA62 READING	+/- TOLERANCE (% + COUNTS)
0	0.00	0 (Input Shorted)
+1	1.00	2
-10	-10.00	4
+19	19.00	6
+21	21.0	2
-21	21.0	2
+100	100.0	4
+190	190.0	6
-190	-190.0	6
+210	210	2
+1000	1000	4
-1000	-1000	4

Fig. 12--Tolerances for the DC volts function.

PPV Accuracy

Use the AC calibration voltages to test the PPV function. Remember that a meter calibrator output reads in RMS voltage. Multiply the RMS value by 2.828 for the equivalent peak-to-peak value. (NOTE: This conversion is only accurate for a low-distortion sinewave. Most quality meter calibrators do provide low-distortion sinewaves.)

The absolute accuracy of the peak-to-peak function is tested at 1000 Hz because this frequency is available from most commercial

meter calibrators. The VA62 should read the 1 KHz reference signal within 1%, ±2 counts for any voltage applied to its input

The following table shows typical test points to confirm the PPV function works correctly. Notice that some of the tests are made at 400 Hz rather than 1 KHz. These values are selected because many meter calibrators do not supply 1 KHz signals at amplitudes large enough to test the full operating range of the VA62. The +/- count tolerance in the table includes the frequency response spread for a typical unit at 400 Hz so a standard calibrator may be used.

FREQUENCY	RMS VALUE	P-P VALUE	VA62 READING	+/- COUNTS
(shorted)	--	--	0.00	0
1 KHz	0.3536	1	1.0	2
1 KHz	3.536	10	10.0	3
1 KHz	6.719	19	19.0	4
1 KHz	7.426	21	21	2
1 KHz	35.36	100	100	3
1 KHz	67.19	190	190	4
400 Hz	74.26	210	210	25*
400 Hz	353.6	1000	1000	110*
400 Hz	671.9	1900	1900	220*

*Includes typical frequency response spec.

Fig. 13--Tolerances for the PPV test.

PPV Frequency Response

The peak-to-peak function has a second specification that indicates the accuracy at different frequencies. While the 1 KHz calibration point is included in the spread of frequencies covered by the frequency specification, the two don't directly relate because of the way the industry specifies frequency response. Frequency response is defined as the variance from the average value between the upper and lower cutoff points, not from the 1 KHz calibration point. You need a signal source adjustable from 30 Hz to 5 MHz to test the frequency response. The accuracy must be 0.5 dB (or better) in order to confirm the frequency response.

You cannot use a standard oscilloscope to test the calibration of the VA62 because the ±1dB specification of the VA62 PPV function is nearly 4 times more accurate than the typical ±3 dB specification an oscilloscope. The ±1 dB VA62 specification represents a possible variance through its frequency range of +12.2/-10.9 percent from the average value, while a ±3 dB scope spec represents a possible error of +41.2/-29.2 percent. (NOTE: You can use the digital PPV of the Sencore SC61 Waveform Analyzer to document a signal source used to test the VA62 because its ±0.5 dB spread across the frequencies measured by the VA62 represents a possible error of only +5.9/-5.6 percent.)

Notice that the ±1 dB frequency response below 200 volts

extends from 30 Hz to 5 MHz, while the frequency response from 200 volts to 2000 volts extends from 30 Hz to 150 KHz.

Select several frequencies to test the frequency response. These procedures do not give specific details on the frequencies or the tolerance, since the specifics will depend on the test equipment you select.

When documenting the frequency response of the PPV function:
1. Document the readings at various frequencies by comparison to a known-accurate signal source.
2. Calculate the average variance through the band of frequencies tested.
3. Calculate the dB ratio between the highest reading and the average and between the lowest reading and the average using the formula:

dB= 20 x Log (Reading/Average)

NOTE: Use base-10 logarithms.

Ringing Test

You will need a good deflection yoke or flyback transformer to test the Ringing Test. You will compare the actual ringing value measured on an oscilloscope with the ringing value shown on the VA62 digital readout.

The Ringing Test applies an exciting pulse to a resonant circuit consisting of the coil under test and a capacitor inside the VA62. This causes the circuit to oscillate. Digital circuits count the number of cycles the coil rings until the signal damps to 25 percent of the original exciting pulse value. The exact resonance is determined by the value of the internal capacitor, which is selected by the IMPEDANCE MATCHING switch.

Since the number 10 has been selected as the dividing line between good and bad coils, the calibration of the test near 10 is more important than for other readings. Therefore, the test should take place using a number close to 10.

You will connect the scope across the coil under test to observe the damped sinewave that occurs after the test pulse from the VA62 causes the coil to oscillate. The pulse is only present every few tenths of a second. You will find the scope gives an easier to view display if you set the triggering circuits to "normal", which prevents the scope trace from sweeping between occurances of the test pulse. (NOTE: A conventional, triggered-sweep scope can be used to view the signal if you monitor the signal carefully. If you have access to a storage scope, you can use it to "freeze" a single burst of the signal for easier counting.)

To test the Ringing Test:
1. Connect the Ringing Test connectors to the yoke or flyback.
2. Connect your scope probe in parallel with the Ringing Test

leads, with the ground connected to the black test lead.

3. Adjust the RINGING TEST IMPEDANCE MATCH switch for a reading as close to 10 as you can get with the coil you are using as a reference (the exact number is not important).
4. Adjust the sweep rate and the trigger circuits of the scope to display the resulting bursts of signal.
5. Adjust the scope's vertical gain until the exciting pulse fills the 8 vertical divisions of the scope CRT.
6. Locate the point on the waveform where the signal fills the center two divisions of the CRT.
7. Count the number of ringing cycles between the first exciting pulse and the point identified in step 6. The digital display on the VA62 must read within 2 counts of this value.

Power Supply Monitor

This test confirms that monitor functions of the internal digital meter are accurate, and confirms the adjustable power supply works correctly. The test requires the use of an external meter capable of measuring DC voltage and DC current to at least 1.5 amps.

To test the power supply and monitor:

1. Set the external meter to measure at least 44 VDC.
2. Connect the external meter to the DC OUTPUT jacks in the lower, left-hand corner of the unit.
3. Set the VA62 DIGITAL METER switch to the "DC PWR SUPPLY VOLTS" position.
4. Adjust the DC POWER SUPPLY control to maximum output (fully clockwise).
   a. The external digital meter must measure between 33 and 40 volts DC.
   b. The VA62 meter must show the same reading as the external meter, ±4 counts.
5. Move the VA62 DIGITAL METER switch to the "DC PWR SUPPLY CURRENT" position.
6. Change the external meter to its current function. (NOTE: This applies a direct short to the VA62 output to test the maximum current allowed by the current-limited power supply.)
   a. The external meter should show at least 1 amp and no more than 1.3 amps.
   b. The VA62 meter must show the same reading as the external meter, ±7 counts.

Drive Monitor Tests

These tests confirm that each of the drive monitoring functions work correctly. You will apply a signal to your oscilloscope and confirm that each output produces a signal and that the meter shows approximately the same value as displayed on the oscilloscope.

> NOTE: The scope is used to confirm a signal with the correct waveshape and approximately correct amplitude is present. Remember that the digital peak-to-peak function of the VA62 is much more accurate than the vertical calibration of a standard oscilloscope, so

don't bother comparing the exact peak-to-peak amplitude.

To test the monitor functions:
1. Connect your oscilloscope to the "30 Hz SERVO DRIVE" output, connecting the probe ground to the black lead.
2. Turn the SERVO DRIVE control fully clockwise.
3. Set the DIGITAL METER switch to the "30 Hz SERVO DRIVE" position.
   a. Confirm the oscilloscope shows a 30 Hz square wave of approximately 30 VPP.
   b. Confirm the digital readout shows a reading of approximately 30 volts.
4. Set the DRIVE SIGNAL switch to the "VERT SYNC" position.
5. Connect your scope to the DRIVE OUTPUT, probe ground to black lead.
6. Set the DRIVE RANGE switch to the "30VPP" position.
7. Set the DRIVE LEVEL control fully clockwise.
8. Set the DIGITAL METER switch to the "DRIVE SIGNAL" position
   a. Confirm the oscilloscope shows a 60 Hz vertical drive signal of approximately 30 VPP.
   b. Confirm the digital readout shows a reading of approximately 30 volts.
9. Connect your oscilloscope to the "3.58 MHz DRIVE" output, probe ground to black lead.
10. Set the "3.58 MHz DRIVE" control fully clockwise.
11. Set the DIGITAL METER switch to the "3.58 MHz DRIVE" position.
    a. Confirm the oscilloscope shows a 3.58 MHz signal of approximately 30 VPP.
    b. Confirm the digital readout shows a reading of approximately 30 volts.

I. DRIVE SIGNAL TESTS

The tests of the drive outputs confirm each signal has the correct amplitude and waveshape. Refer to the photos on page 27 of the "Operation and Application" manual for typical waveshapes.

The Sencore SC61 Waveform Analyzer provides the best instrument for testing these outputs. If you do not use the SC61, you will need to connect an oscilloscope in parallel with a frequency counter to make the required measurements of frequency, amplitude, and waveshape.

> NOTE: Signal levels as high as 300 VPP will be applied to the drive output. Observe the input protection specifications of your frequency counter if you must use a separate counter.

To test the drive outputs:
1. Connect the SC61 (or parallel scope/frequency counter combination) to the DRIVE OUTPUT, probe ground to black jack.
2. Set the DRIVE RANGE switch to the "3VPP" position and the DRIVE LEVEL control fully clockwise.
3. Set the DRIVE SIGNAL switch to the "AUDIO" position.

4. Confirm none of the audio signals show clipping and that they meet the following frequency specifications:

FREQUENCY	+/- Hz
333 Hz	17
1 KHz	100
5 KHz	500
7 KHz	700

Fig. 14--Frequency tolerances for audio function.

5. Change the DRIVE SIGNAL switch to the "VERT SYNC" position.
   a. Confirm the frequency is 59.94 Hz, ±2 counts with the INTERLACE ADDER button depressed.
   b. Confirm the frequency is 60.05 Hz, ±2 counts with the INTERLACE ADDER button in the "out" position.
6. Move the DRIVE SIGNAL switch to the "HORIZ XISTOR DRIVE" position. Confirm the frequency reading is 15734.2 Hz, ±2 Hz.
7. Move the AUDIO switch to the "1 KHz" position.
8. Set the DIGITAL METER switch to the "DRIVE SIGNAL" position.
9. Check the 3 volt drives for all signals.
   a. Set the DRIVE RANGE switch to the "3VPP" position.
   b. Set the DRIVE SIGNAL switch to the "VIDEO PATTERN" position.
      (NOTE: Use any video pattern EXCEPT the "Color Bars" pattern. The "Color Bars" will show a lower peak-to-peak amplitude than the other patterns because it does not contain any peak-white information. This lower amplitude is normal, and should not be considered a defect.)
   c. Rotate the DRIVE LEVEL control fully counterclockwise.
      1) Confirm the waveform does not show distortion.
      2) Confirm the output is 3.0 volts, ±0.5 volts.
      3) If you are using an SC61, confirm the VA62 digital reading is within 0.4 VPP of the SC61 reading.
   d. Repeat step 9c (1-3) when the DRIVE LEVEL control is fully clockwise.
   e. Repeat all tests in steps 9c and d for all the other positions of the DRIVE SIGNAL switch.
10. Check the 30 volt drive for all signals.
   a. Set the DRIVE RANGE switch to the "30VPP" position.
   b. Set the DRIVE SIGNAL switch to the "VIDEO PATTERN" position.
   c. Rotate the DRIVE LEVEL control fully counterclockwise.
      1) Confirm the waveform does not show distortion.
      2) Confirm the output is 30 volts, ±5 volts.
      3) If you are using an SC61, confirm the VA62 digital reading is within 4.0 VPP of the SC61 reading.
   d. Repeat step 10c (1-3) when the DRIVE LEVEL control is fully clockwise.
   e. Repeat all tests in steps c and d for all the other positions of the DRIVE SIGNAL switch.
11. Check the 300 volt drive for all signals.
   a. Set the DRIVE RANGE switch to the "300VPP" position.
   b. Confirm the warning LED flashes for any setting of the

DRIVE LEVEL control.

c. Set the DRIVE SIGNAL switch to the "VIDEO PATTERN" position. (NOTE: The frequency response of the 300 volt range must roll off much faster than the other two ranges. The 1.5 MHz bar will normally be 30% the amplitude of the "0 Ref" bar.)

d. Rotate the DRIVE LEVEL control fully counterclockwise.
   1) Confirm the waveform does not show distortion.
   2) Confirm the output is 300 volts, +50 volts.
   3) If you are using an SC61, confirm the VA62 digital reading is within 36 VPP of the SC61 reading.

e. Repeat step 11d (1-3) when the DRIVE LEVEL control is fully clockwise.

f. Repeat all tests in steps 11d and e for all the other positions of the DRIVE SIGNAL switch.

12. Set the DRIVE LEVEL control to the zero-center detent position. The output should show less than 10 volts P-P.

13. Check the output for loading.
   a. With the DRIVE LEVEL control at zero and the DRIVE RANGE switch in the "300VPP" position, connect a 10 kilohm resistor across the output leads.
   b. Set the DRIVE SIGNAL switch to the "AUDIO" position.
   c. Rotate the DRIVE LEVEL control fully clockwise. The output should not be less than 50% of the unloaded value.
   d. Repeat the test with the DRIVE LEVEL control rotated fully counter-clockwise.
   e. Replace the 10 kilohm resistor with a 100 ohm resistor.
   f. Move the DRIVE RANGE switch to the "30VPP" position.
   g. The drive output must show no less than half the reading without loading when the DRIVE LEVEL control is rotated fully clockwise or counter-clockwise.

14. Test the "3.58 MHz DRIVE".
   a. Connect the scope to the "3.58 MHz DRIVE" output, scope ground to black lead.
   b. Move the DIGITAL METER switch to the "3.58 MHz DRIVE" position.
   c. Turn the "3.58 MHz DRIVE" control to maximum.
   d. The digital meter must read between 25 and 35 VPP. (If you are using a Sencore SC61, the reading must be within 4 volts.)
   e. The oscilloscope waveform must be a square wave with slow risetime.
   f. The frequency of the signal must be between 3.57943 and 3.57964 MHz.
   g. Turn the "3.58 MHz DRIVE" control to minimum. The reading should be less than 1 VPP.

15. Test the "30 Hz SERVO DRIVE".
   a. Connect the one scope channel to the "30 Hz SERVO DRIVE" output, scope ground to black lead.
   b. Connect the second scope channel to the "DRIVE OUTPUT".
   c. Move the DRIVE SIGNAL switch to the "VIDEO PATTERN" position.
   d. Set the scope for dual trace, triggering from the "30 Hz SERVO DRIVE" output.
   e. Confirm the "30 Hz SERVO OUTPUT" signal is a square wave

which is locked to the vertical sync pulses.

f. Trigger the scope from the vertical sync pulse on the composite video signal coming from the "DRIVE OUTPUT" jack. (NOTE: This requires the use of sync-separators. If your scope does not include circuits to trigger from vertical sync, you may need to connect the VA62 to an operating TV receiver and then connect your scope to the output of the vertical integrating filter--the input of the vertical oscillator.)

g. Carefully adjust the sweep rate of the scope until the square wave coming from the "30 Hz SERVO DRIVE" output is locked on the scope CRT. (NOTE: This usually requires an odd number of vertical sync pulses on the CRT, such as one on the left, one in the center, and one on the right of the CRT.)

h. Pull the "30 Hz SERVO DRIVE" control to its out position (or press it in if it is already out). The phase of the square wave on the scope should reverse as you change the position of the polarity switch.

i. Move the DIGITAL METER switch to the "30 Hz SERVO DRIVE" position.

j. Turn the "30 Hz SERVO DRIVE" control to maximum.

h. The digital meter must read between 25 and 35 VPP. (If you re using a Sencore SC61, the reading must be within 3.6 volts.)

k. Turn the "30 Hz SERVO DRIVE" control to minimum. The reading should be less than 1 VPP.

III. RECALIBRATION

The following procedures allow you to return the VA62 to normal performance if it failed one or more of the performance tests covered in section II. In general, it is only necessary to recalibrate the sections of the unit that failed the performance tests, rather than having to go through all of the adjustments every time.

It is not necessary to remove any of the PC boards from the unit for recalibration. Shields that cover PC boards have access holes so you can adjust the controls with the shields in place.

Some of the recalibration adjustments interact with others. These instructions group all inter-related adjustments into one series of procedures. Be sure to run through the entire group of adjustments to insure the adjustment of one control does not

adversely affect another, related circuit.

After recalibration, recheck the operation of the affected circuits by repeating the performance test for the areas involved. Sencore service procedures also call for operation of the unit under power for 24 hours, followed by a complete performance test of all functions to insure that the circuits are not drifting or aging.

Control Numbers

Each control's number in the procedures indicates where each control is located. Consider, for example, a control with a number like "R1110". This number includes the PC board number (the "1100" board, indicating the "Video Pattern" board) plus the component number on that board (R10). The legend printed on the PC board (or shown on board location diagrams in these instructions or in the VA62 "Schematic and Parts List") show only the component number (such as "R10"). The board-location photographs on the front page of the VA62 "Schematic and Parts List" shows the numbers assigned to the individual PC boards (such as "1100").

There are a few exceptions to these general rules when a single PC board contains more than 100 resistors. If so, the instructions will specify both the resistor number and the board number (such as "Adjust R115 on the 1100 board").

A. POWER SUPPLY TESTS

The power supplies should be tested before recalibrating the internal controls. If a supply is outside its normal operating voltage, is may affect the circuits to the point that they cannot be recalibrated to their normal operating points. Determine whether the incorrect voltage is caused by a bad power supply (including the regulator) or excessive loading from another circuit.

Except for the 400 volt supply (which powers the 300 VPP drive output), all other supplies are regulated with ICs. These regulators are self-protecting to prevent damage in case one of their loads becomes shorted. The regulator may, however, go into a shutdown mode if they become too hot during an overload. If so, correct the short and then remove power from the VA62 so the regulator can cool and reset itself.

The "900 Power Supply" board contains circuits with three separate, isolated grounds. Be certain you connect your test equipment to the correct ground as you test each of the power supply circuits. A wire ground loop is provided for each group of power supplies that require testing to simplify your connection. (NOTE: You will not damage the VA62 by connecting to the wrong ground, but will get inaccurate readings.)

The wiring harnass for the various PC boards contain color-coded wires for each power supply. Use these color codes as your

reference when testing the power supply. It doesn't matter which connector you use when testing the main power supply circuits because all of the wires of a given color are in parallel with each other. (For example, all red wires connect to the same 5 volt power supply.)

NOTE: These power supply voltages are listed for troubleshooting purposes only. They are not part of an overall performance test. The tolerances shown below are typical variations, but should not be used to reject a VA62 if it has passed all funcitonal and specification tests covered in the performance tests in part II of this document.

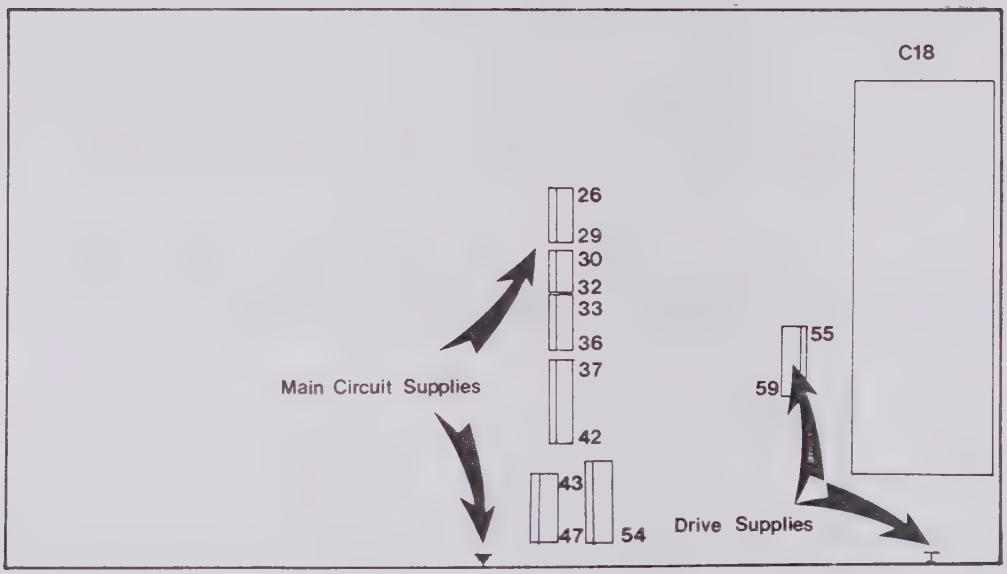

Fig. 15--Main Test points for "900" power supply board.

Your test should include both a test of the DC voltage and of AC ripple. The "ripple" may be from the AC line voltage, or may be in the form of signals coming back from circuits in the VA62. Therefore, measure total peak-to-peak value, without worrying about whether the interference is coming from the AC line or from the other circuits. The normal amount of ripple is shown in the following tables.

Main Circuit Supplies

The group connectors near the center of the 900 PC board feed most of the circuits in the VA62. These power supplies are referenced to chassis ground. Use the ground loop centered near the edge of the board closest to the hinge (adjacent to C910) to connect your equipment during the following tests.

The following are the normal DC and AC P-P ripple values:

SUPPLY	TOLERANCE (+/- VOLTS)	COLOR WIRE	MAXIMUM PPV RIPPLE
+5	0.5	Red	0.5
+15	1.5	Orange	0.5
+30	3.0	Grey	0.5
-15	1.5	Violet	0.5
-20	4.0	White	1.0

Fig. 16--Main power supply tolerances.

Drive Supplies

The connector carrying the power supplies for the drive circuits is located on the right-hand part of the board, near C918--the large electrolytic filter for the 400 volt supply. The power supplies for the drive circuits are isolated from chassis ground. The brown wire from the power connector is the ground connection. The ground loop for these supplies is located in the right-hand corner on the edge of the PC board closest to the hinge (adjacent to C918).

SUPPLY	TOLERANCE (+/- VOLTS)	COLOR WIRE	MAXIMUM PPV RIPPLE
+15	1.5	Orange	0.5
+30	3.0	White	0.5
-30	3.0	Green	0.5
+400	50*	Red	4.0

*Unregulated, depends on line voltage and load conditions.

Fig. 17--Drive power supply tolerances.

B. VIDEO PATTERN BOARD CALIBRATION

The VA62 contains a number of calibration adjustments on the "1100, Video Pattern" PC board which affect the video patterns. The adjustment of these controls requires that a broadcast-type waveform monitor and vectorscope be connected to the "VCR STANDARD" output jack. Use the same setup used in the "Performance Test" section of these instructions to correctly connect the two instruments to the VA62 in a "loop-through" manner.

Because some of the adjustments interact with others, be sure to start at step 1, and go through the entire video pattern alignment if any of the video adjustments require touch-up.

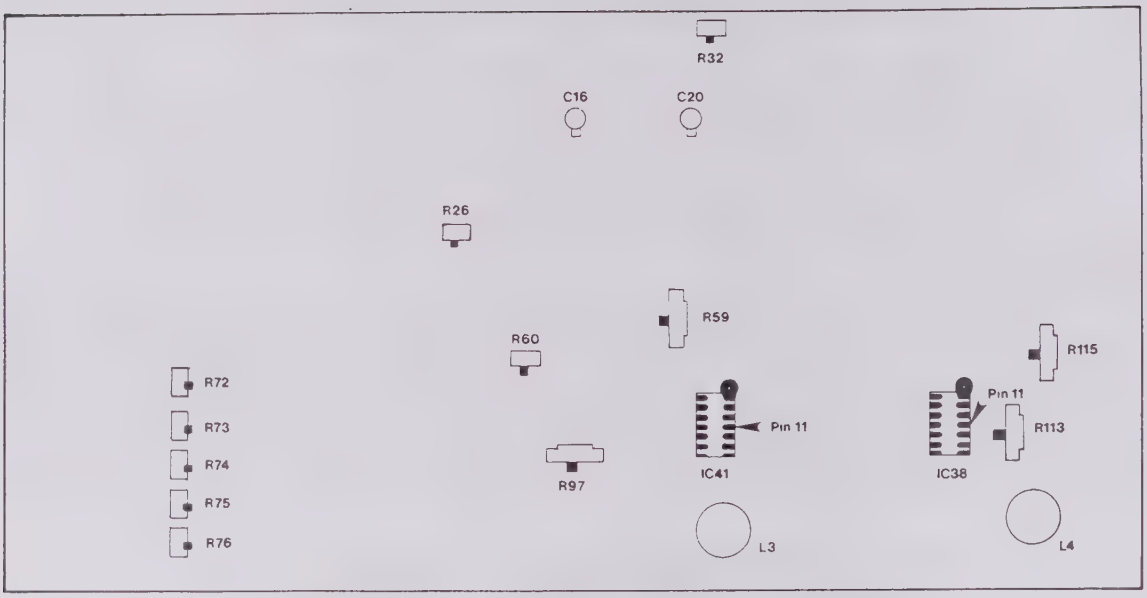

Fig. 18--Location of controls on "1100" video pattern board.

To align the video patterns:

1. Set the "CHROMA BAR SWEEP" duty cycle adjustment.
   a. Set the frequency response of the waveform monitor to the "IRE" position.
   b. Set the VA62 VIDEO PATTERN switch to the "CHROMA BAR SWEEP" position with the 3.0, 3.5, and the 4.0 MHz "MULTIBURST BAR SWEEP INTERRUPT" buttons depressed.
   c. Adjust R1132 until the 4.0 MHz (right-hand) bar shows as a single image.
   d. Return the waveform monitor frequency response to "flat".
2. Adjust the phase-locked oscillators.
   a. Connect the frequency counter to the "3.58 MHz DRIVE" output.
   b. Adjust the "3.58 MHz DRIVE" control and/or the frequency counter for a stable reading.
   c. Adjust C1120 for a reading of 3.579545 MHz.
   d. Connect your scope to pin 11 of IC1138.
   e. Adjust the BOTTOM slug of L1104 for the highest amplitude signal.
   f. Adjust the TOP slug of L1104 for the best looking waveform.
   g. Check that the frequency is 14.31815 MHz.
   h. Move the scope to pin 11 of IC1141.
   i. Adjust the BOTTOM slug of L1103 for the highest amplitude signal.
   j. Adjust the TOP slug of L1103 for an amplitude of 4.75 to 5.00 VP-P.
   k. Check that the frequency is 18.4090 MHz

3. Adjust the phase of the COLOR BARS pattern.
   a. Move the VIDEO PATTERN switch to the "COLOR BARS" position.
   b. Confirm the vector scope is in its calibrated mode. Locate the point on the zero-degree phase line representing an ideal color burst amplitude. Adjust R1175 until the color burst's amplitude is on the calibrated line of the vectorscope.
   c. Adjust C1116 until the red color bar (the third bar counting clockwise from burst) is centered on the R-Y vector (the vertical graticule line).
   d. Repeat steps 3 b and c until the two controls are properly balanced.
4. Adjust the frequency of the 3.58 MHz oscillator.
   a. Connect the "3.58 MHz DRIVE" output to the frequency counter input.
   b. Adjust the "3.58 MHz DRIVE" control and/or the frequency counter input control for a stable reading.
   c. Adjust C1120 for a frequency reading of 3.579555 MHz (NOTE: This is 10 Hz higher than the normal NTSC color burst frequency. You set the oscillator high to compensate for the additional internal temperature of the VA62 when the case is closed.)
5. Adjust the black level.
   a. Move the VIDEO PATTERN switch to the "MULTIBURST BAR SWEEP" position.
   b. Adjust the vertical position control of the waveform monitor until the video pattern blanking is on the zero IRE mark.
   c. Set the waveform monitor for calibrated vertical gain.
   d. Adjust R1176 until the black line of the video pattern is at 7.5 IRE units.
6. Adjust the "CHROMA BAR SWEEP" cyan bar.
   a. Move the VIDEO PATTERN switch to the "CHROMA BAR SWEEP" position.
   b. Adjust R1173 until the center, cyan bar has the correct amplitude on the vectorscope.
   c. Adjust R1159 until the center, cyan bar has the correct phase on the vectorscope.
   d. Repeat steps 6 a and b until the cyan vector has the correct phase and amplitude.
7. Adjust the sync-to-video ratio.
   a. Move the VIDEO PATTERN switch to the "CHROMA BAR SWEEP" position.
   b. Adjust the waveform monitor's gain and vertical position controls until the tip of the sync pulse just touches the "-40" IRE marking and the white tip just touches the +100 IRE marking.
   c. Adjust R1174 until the blanking pulse is at the zero IRE line.
   d. Repeat steps 7 b and c until the pattern has the correct ratio from sync-tip to blanking compared to peak-white to blanking.
8. Recheck the phase and amplitude of the cyan vector. Repeat steps 6 and 7 until the vector and the sync-to-video ratio

all are correct.

9. Adjust the "10 BAR STAIRCASE" pattern.
   a. Move the VIDEO PATTERN switch to the "10 BAR STAIRCASE" position.
   b. Adjust the waveform monitor until the sync pulse tip is at -40 IRE units and the blanking is at zero IRE units.
   c. Adjust R1197 until the top step of the video pattern just reaches the +100 IRE marking. (Measure only to the flat top of the 10th step--ignore the extra pulse on the extreme right side of the pattern.)
   d. Adjust R1160 until the first 5 bars properly line up with the 10% markings on the waveform monitor.
   e. Repeat steps 9 b through d if necessary.
10. Adjust the VIR signal.
   a. Move the VIDEO PATTERN switch to the "CHROMA BAR SWEEP" position; depress the "VIR ADDER" button.
   b. Set the horizontal sweep of the waveform monitor to the "2V Magnified" position.
   c. Adjust the horizontal position control of the waveform monitor to view the VIR signal on the back porch of the vertical sync.
   d. Adjust R1172 until the center pedestal level of the VIR signal is at the 50 percent mark on the waveform monitor.
   e. Locate the VIR vector on the vectorscope to the left of the color burst vector (NOTE: This vector is considerably dimmer than the other vectors. Turn the VIR ADDER switch off and on to confirm you have the correct vector.)
   f. Adjust R113 on the 1100 board *9 until the VIR signal has the same phase as the color burst.
11. Adjust the "DOT SIZE" limit.
   a. Move the VIDEO PATTERN switch to the "CROSSHATCH" position.
   b. Move the bandwidth switch on the waveform monitor to the "IRE" position.
   c. Adjust the DOT SIZE control to minimum (fully counter-clockwise).
   d. Adjust the gain and position controls of the waveform monitor until the sync pulse falls between zero and -40 IRE units.
   e. Adjust R1126 until the vertical lines fall between 20 and 30 IRE units on the waveform monitor.
12. Adjust the EXTERNAL MODULATION gain.
   a. Feed a calibrated 1 VP-P video pattern to the EXTERNAL MODULATION jack in the lead storage compartment on the back of the VA62. The pattern must include a peak-white signal. The "Split-Field" signal from the Sencore NT64 provides this reference.
   b. Set the VIDEO PATTERN switch to the "EXTERNAL MODULATION" position.
   c. Adjust R115 on the 1100 board *10 until the waveform

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*9 This part number does not follow the usual numbering sequence because there are more than 100 resistors on the 1100 board.

*10 This part number does not follow the usual numbering sequence because there are more than 100 resistors on the 1100 board.

monitor shows the amplitude of the output signal is the same as the amplitude of the input signal.

C. AUDIO OSCILLATOR BOARD ADJUSTMENTS

The adjustments on the audio board insure that all four audio tones have the same amplitude so they produce equal frequency modulation of the FM carrier.

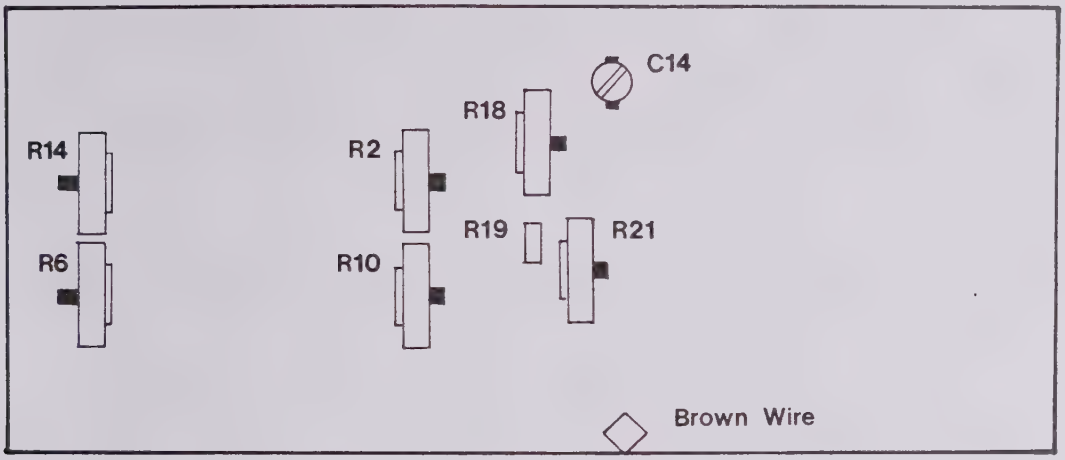

Fig. 19--Calibration points on the "700" audio circuits.

To calibrate the audio board:

1. Connect your oscilloscope to the single brown wire coming from the edge of the "700" board closest to the outside of the VA62. (NOTE: This connector appears to be connected to the ground foil, but is actually insulated from ground.)
2. Set the AUDIO switch to the "333 Hz" position.
3. Adjust R714 for a 5 VPP reading.
4. Set the AUDIO switch to the "1 KHz" position.
5. Adjust R710 for a 5 VPP reading.
6. Set the AUDIO switch to the "5 KHz" position.
7. Adjust R706 for a 5 VPP reading.
8. Set the AUDIO switch to the "7 KHz" position.
9. Adjust R702 for a 5 VPP reading.
10. Set the RF-IF SIGNAL switch to the "STD TV" position.
11. Connect your DC voltmeter to the ungrounded end of R719 (this end has the longer lead).
12. Adjust R718 for a DC reading of 2 volts.
13. Connect your frequency counter to the RF-IF OUT jack.
14. Move the RF-IF SIGNAL switch to the "4.5 MHz FM" position.
15. Set the AUDIO switch to "OFF".
16. Adjust C714 clockwise until the frequency counter shows an unstable reading (indicating the 4.5 MHz oscillator is unlocked).
17. Count the number of turns of C714 as you turn it in the counter-clockwise direction until the 4.5 MHz oscillator again becomes unlocked.
18. Turn C714 back in the clockwise direction, one-half the number of turns counted in step 17 to set it to its maximum stability point.

19. Connect your frequency deviation meter to the RF-IF OUT jack.
20. Turn the RF-IF SIGNAL switch to the "4.5 MHz FM" position.
21. Set the AUDIO switch to the "1 KHz" position.
22. Adjust R721 for a frequency deviation reading of 15 KHz.

D. DRIVE SIGNALS

The first step of calibrating the drive signals section is to adjust the circuits so they do not clip the signals for any signal level or polarity of drive signal. Then, the frequency response of the drive amplifiers is adjusted so you have predictable results when injecting signals in the video and color circuits. Finally, the various drive signals are balanced against each other so that all have approximately the same range of signal levels.

The first adjustments are located on the "1000" drive board. The balancing adjustments are located on the "2100" board just behind the DRIVE SIGNAL switch.

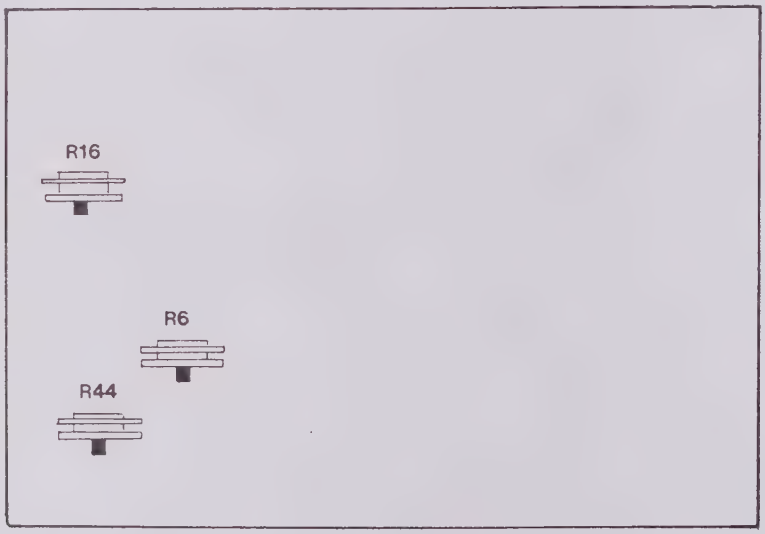

Fig. 20--Location of the calibration adjustments on the "1000" drive board.

WARNING

Use caution when making measurements or adjustment on the drive signal board. Some test points and components have 400 VDC present.

To calibrate the drive signals:

1. Connect your scope to the DRIVE OUTPUT jack, probe ground to black connector.
2. Set the DRIVE SIGNAL switch to the "AUDIO" position.
3. Set the AUDIO switch to the "333 Hz" position.
4. Set the DRIVE RANGE switch to the "30VPP" position.
5. Set the DRIVE LEVEL control fully clockwise.

6. Adjust R1006 for 30 volts peak-to-peak at the output.
7. Rotate the DRIVE LEVEL control fully counter-clockwise and confirm there is no clipping or distortion in the scope waveform.
8. Test the DRIVE RANGE switch in all three positions with the DRIVE LEVEL control both fully clockwise and fully counter-clockwise in all three positions. Balance the adjustments of R1006 and R1016 for the best balance between correct signal level and lowest distortion in all combinations. (NOTE: Low distortion is more important than exact signal levels. The exact level will be adjusted later.)
9. Set the DRIVE SIGNAL switch to the VIDEO PATTERN position.
10. Set the VIDEO PATTERN switch to the "MULTIBURST BAR SWEEP" position.
11. Set the DRIVE RANGE switch to the "3VPP" position.
12. Adjust the DRIVE LEVEL control until the "0 REF" MULTIBURST BAR SWEEP bar is exactly 1 volt peak-to-peak.
13. Adjust R1044 until the eighth bar (3.5 MHz) bar is between 0.4 and 0.6 volts peak-to-peak. (The 6th bar--2.5 MHz--must be between 0.7 and 1.0 volts peak-to-peak.)
14. Balance the controls on the "2100" board for the best balance between the 3 and 30 volt settings of the DRIVE RANGE switch for each of the associated drive signals. (NOTE: The PC board legend shows which signal each control affects.)

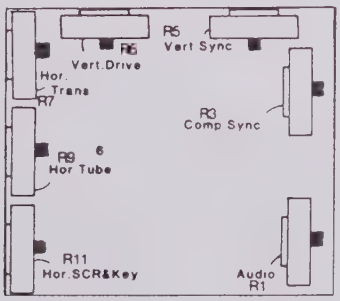

Fig. 21--Location of controls on the "2100" output board.

NOTE: The "HORIZ SCR DRIVE" position and the "HORIZ KEY PULSE" position of the DRIVE SIGNAL switch produce the same signal. This simplifies operation of the unit since the user can relate the front-panel nomenclature to the specific circuit being serviced.

E. PLL BOARD

The calibration of the PLL board requires a high sensitivity frequency counter. The adjustment of these controls affects both the accuracy and the lock-in range of the various phase-locked-loops used to generate the RF and IF signals.

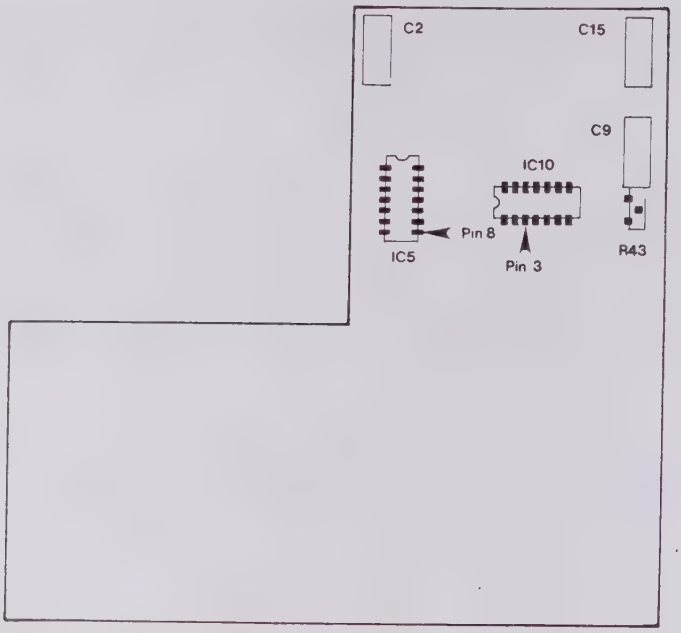

Fig. 22--Location of calibration points on the "200" PLL board.

To calibrate the PLL circuits:

1. Connect the counter probe to pin 8 of IC205.
2. Set the RF-IF SIGNAL switch to the "STD TV" position.
3. Select channel 6.
4. Adjust C215 for a frequency reading of 4.000000 MHz.
5. Push the "Up Channel" button to switch the VA62 to channel 7.
6. Adjust C202 for a frequency reading of 3.5000000 MHz.
7. Move the frequency counter probe to pin 3 of IC 210.
8. Adjust C209 for a frequency reading of 1.02400 MHz.
9. Move the frequency counter to the RF-IF output.
10. Move the RF-IF SIGNAL switch to the "35-50 MHz PROG" position.
11. Select a frequency reading of 35.00 MHz.
12. Adjust R243 through its entire range to determine the two places the frequency readings do not lock.
13. Physically center R243 between the two points in its rotation that cause the PLL dropped out of lock.
14. Switch the RF-IF SIGNAL switch to the "STD TV" position and back to the "35-50 MHZ PROG" position. Confirm the oscillator remains locked. If not, readjust R243 for correct lock-in as you switch between functions.

F. OUTPUT LEVEL CAL

The channel-by-channel calibration of the output attenuator is controlled by the RF/PLL microprocessor. At the factory, each VA62 is tied to a computer which tests the unit over all RF frequencies. A memory chip is then programmed with channel-by-channel compensation, resulting in a virtually flat attenuator from the lowest to the highest frequencies the attenuator controls.

NOTE: Because of the complexity of reprogramming the microprocessor memory, procedures for recalibration of the microprocessor-compensated attenuator are not covered in these instructions. Sencore recommends that any VA62 with large frequency-dependent attenuator errors be returned to the factory for repair and recalibration.

Two calibration controls remain to compensate for drift in the various components. These controls affect the output of the attenuator at the ".5" and the "1" settings of the RF-IF LEVEL VERNIER control. Careful balancing of these controls may allow you to bring frequency-selective errors into calibration as you "split the difference" between the channels with the highest and lowest output.

NOTE: All testing and calibration of the vernier is done with the step attenuator in the "HI" position.

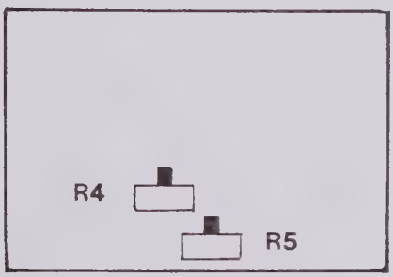

Fig. 23--Location of output controls on "2000" Up/Down Channel Board.

To calibrate the RF level controls:

1. Connect a properly terminated (75 ohm) spectrum analyzer or signal strength meter to the RF-IF OUT jack.
   NOTE: Most spectrum analyzers have 50 ohm inputs. Use the correct 75 ohm to 50 ohm adapter to match impedances. Then remember to include the losses of the adapter when converting the spectrum analyzer readings to microvolts.
2. Set the RF-IF SIGNAL switch to the "STD TV" position; select channel 2.
3. Set the RF-IF LEVEL switch to the "HI" position.
4. Set the RF-IF LEVEL VERNIER control to the "1" position.
5. Adjust R2004 for an output level of 1000 microvolts.
6. Set the RF-IF LEVEL VERNIER control to the ".5" position.
7. Adjust R2005 for an output level of 500 microvolts.
8. Repeat steps 4-7 until both readings are correct.
9. Change to channel 13 and test the levels at ".5" and "1". Balance the controls, if necessary, for correct levels on channel 2 and 13 for settings of ".5" and "1".

G. 45.75 OSCILLATOR CAL

The adjustment of the 45.75 MHz oscillator provides the correct carrier frequency for the special troubleshooting IF generator as well as the reference carrier for the special trap-setting signals. The calibration of the single coil on the 45.75 MHz oscillator board is done in two steps. The coils is first adjusted for maximum output. It is then readjusted for the correct frequency reading. This requires a scope capable of measuring 50 MHz and a frequency counter or an integrated measuring system, such as the Sencore SC61 Waveform Analyzer.

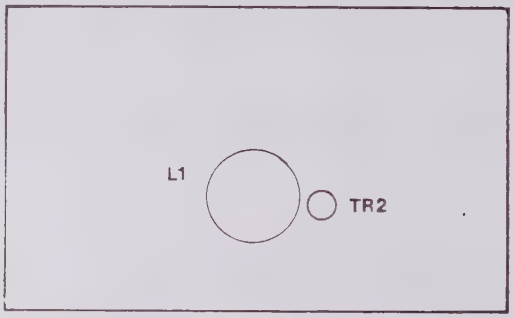

Fig. 24--Location of adjustment points on the 45.75 MHz board.

To adjust the 45.75 MHz oscillator:

1. Connect your oscilloscope to the collector of TR1402.
2. Adjust L1401 until the signal shows maximum amplitude.
3. Disconnect the oscilloscope from the collector of TR1402 and replace it with the frequency counter probe.
4. Readjust L1401 until the frequency counter reads 45.75 MHz.

H. METER/RINGING CIRCUITS

The use of precision parts and automatic circuit provides very low-drift meter circuits. Therefore, there are very few calibration controls needed for the meter circuits.

You will need a high-quality meter calibrator to adjust the meter circuits. The peak-to-peak calibration requires a signal at 1 KHz with low distortion since the calibrators RMS output determines the accuracy of the VA62's PPV input.

> NOTE: The meter circuits have their own ground reference. Make all measurements with the common lead of your testers connected to the shield surrounding the meter board.

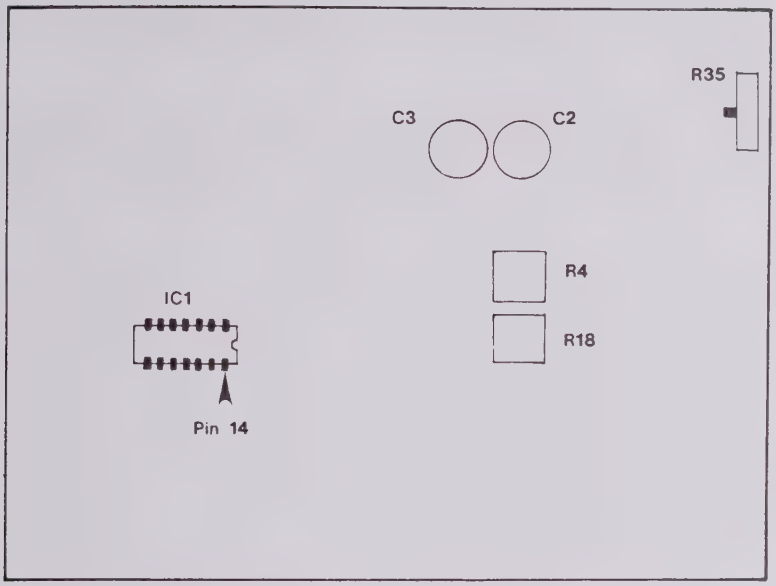

Fig. 25--Calibration control location on the meter board.

DC Volts Calibration

To calibrate the DC function:

1. Set the DIGITAL METER meter switch to the "EXT DCV 2KV DIRECT" position.
2. Remove the shield cover. Measure the DC voltage from pin 14 of IC1 to the meter ground.
3. Apply 19.00 volts to the meter input.
4. Adjust R804 until the DC voltage reads 2.04 volts.
5. Replace the shield.
6. (Still applying 19.00 volts) Adjust R818 until the digital display reads "19.00".
7. Increase the voltage from the calibrator to 190.0 volts.
8. Adjust R818 to split any difference in error between the 19.00 and 190.0 volt reading.
9. Move the DIGITAL METER switch to the "EXT PPV 2 KV MAX" position.
10. Set the meter calibrator to 6.7175 volts (RMS).
11. Adjust C802 until the VA62 digital display reads 19.00 volts P-P.
12. Set the meter calibrator to 67.175 volts (RMS).
13. Adjust C803 until the VA62 digital display reads 190.0 volts P-P.

Ringing Test

Calibration of the Ringing Test requires a good deflection yoke or flyback transformer. You may use the same coil you used to test the Ringing Test in the Performance Tests in Part II of this document. You will use an oscilloscope to determine the exact number of ringing cycles and then calibrate the circuit to agree with the scope measurement.

Since the only critical calibration point falls at readings near

the number "10", you will use the position of the RINGING TEST IMPEDANCE MATCHING switch that reads closest to 10 rather than the one that gives the highest reading for the coil you use.

You may make your measurements by carefully adjusting a standard, triggered-sweep scope. The measurements will be easier to make if you use a storage scope, or a digital storage accessory, such as the "Wavesaver" from Epic Instruments, Foster City, California.

To recalibrate the Ringing Test:

1. Connect the Ringing Test connectors to the yoke or flyback.
2. Connect your scope probe in parallel with the Ringing Test leads, with the ground connected to the black test lead.
3. Set the DIGITAL METER switch to the "RINGING TEST" position.
4. Adjust the RINGING TEST IMPEDANCE MATCH switch for a reading on the VA62 display as close to 10 as you can get with the coil you are using as a reference.
5. Adjust the sweep rate and the trigger circuits of the scope to display the resulting bursts of signal.
6. Adjust the scope's vertical gain control until the exciting pulse fills the 8 vertical divisions of the scope CRT.
7. Locate the point on the waveform where the signal fills the center two divisions of the CRT.
8. Count the number of ringing cycles between the first exciting pulse and the point identified in step 7.
9. Adjust R835 until the VA62 digital meter shows the same number of ringing cycles as measured in step 7.

RECALIBRATION ADDENDUM

Page 38 - 3B CHANGE TO READ:

"Confirm the vector scope is in its calibrated mode. Locate the zero degree phase line. Adjust the phase control of the vector scope so the color burst is on this line."

Page 38 - 5D CHANGE TO READ:
"Push the "0" ref button and the .5MHZ button out, on the VA62 and adjust R1176 until the black level of video pattern is at 7.5 IRE units on the waveform monitor.

Page 38 - 6A(1)

(1) Locate the point on the zero-degree phase line representing an ideal color burst amplitude. Confirm the vector scope is in its calibrated mode. Using the phase adjustment on the vector scope, adjust the signal so it is on the zero-degree line of the vector scope. Adjust R1175 so the burst's amplitude is on the calibrated line on the vector scope.

Page 38 - 6D CHANGE TO READ:

"Repeat steps 6b and c until the cyan vector has the correct phase and amplitude".

Page 38 - 7b CHANGE TO READ:

"Adjust vertical position on waveform monitor so the blanking is on the "0" IRE mark".

Page 38 - 7C CHANGE TO READ:
"adjust variable gain on waveform monitor and R1174, until sync pulse is at -40 IRE units at the same time white is at +100 IRE units.

Page 38 - 7D OMIT

Page 39 - 10a CHANGE TO READ:
"Move the video pattern switch to the "10 bar staircase" position. Depress the "VIR Adder" button".

Page 30 - 10C ADD:
"Be sure sync is at the -40 IRE mark and blanking is at the zero IRE mark".

Page 39 - 10D ADD:
"Switch the video pattern switch to the "Chroma Bar sweep position".

Page 39 - 11B ADD:
"Move the sweep switch on the waveform monitor to the 2H position".

Page 39 - 11C ADD:
"Adjust the position control and the vertical gain on the waveform monitor so sync is on -40 IRE units and blanking is on the zero IRE mark".

Page 39 - 12C CHANGE TO READ:
"Connect ocilloscope to the ungrounded wire near C1128".

Page 39 - 12D CHANGE TO READ:
"Adjust R115 on the 1100 bd (9) for 4.5VPP signal on scope".

PERFORMANCE TEST ADDENDUM

Page 20 - 2d omit
2e omit

Page 20 - ADD
3A. Set the waveform monitor sweep to 2H and response to IRE. Adjust the vertical gain and vertical position so sync pulse is a -40 IRE units and blanking is at "0" IRE units.

B. Turn "Dot size" control to minimum (Fully counter-clockwise). The waveform monitor should show the peaks between 20 and 30 IRE units.

Page 21 - 6B CHANGE TO READ:
Using the vertical gain and the vertical position adjust the waveform on the waveform monitor so the blanking is on the "0" IRE mark, the sync pulse is on the -40 IRE mark and peak white is on the 100 IRE mark. You should be able to adjust these to $\pm$ 2%.

Page 23 - 9b (1) CHANGE TO READ:
Adjust the vertical gain and the vertical position controls of the waveform monitor until the sync pulse is at the -40 IRE mark and blanking is at the "0" IRE mark. The first step should be on the +10 IRE mark and the tenth step should be at the +100 IRE mark. (Note: Measure only to the flat top of the tenth step. Ignore the spike on the extreme right side of the pattern).

Page 23 - 10C CHANGE TO READ
"Connect vector scope to VCR standard output. You should see the pattern on the vector scope. Adjust the vertical gain control and the phase control on the vector scope so the color burst is on the calibrated line. Check the position of all color vectors on the vector scope. Each should fall within the smaller "EIA" box, rather that the larger "FCC" tolerance boxes. Overall amplitude of signal should be 1V PP $\pm$ 10% as measured on waveform monitor or ocilloscope.

MP MASTER
MA25050